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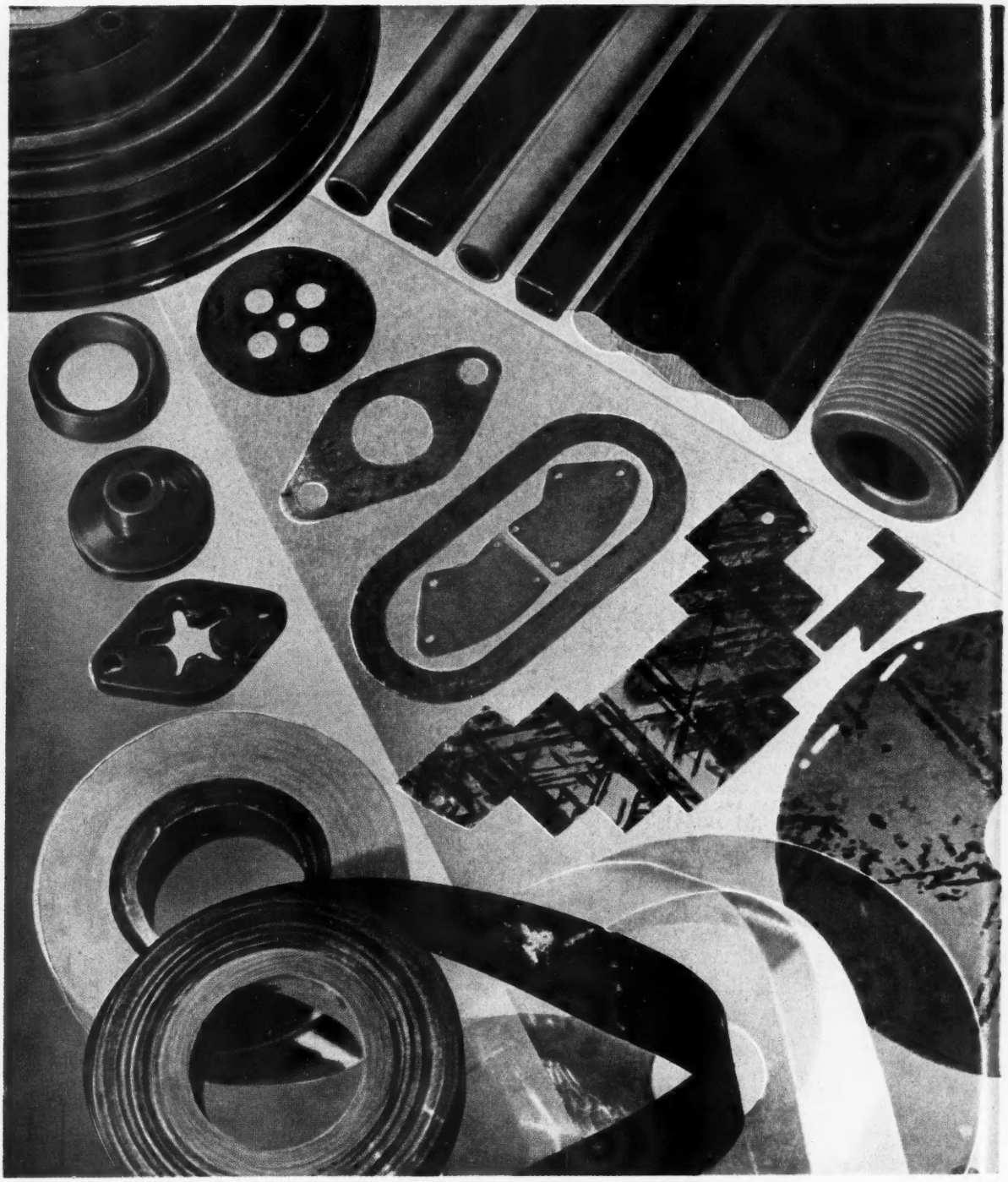

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ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E.
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6 MAY 1955

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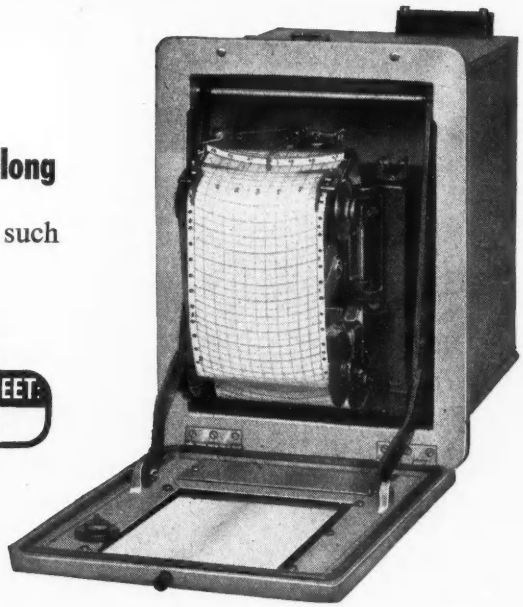

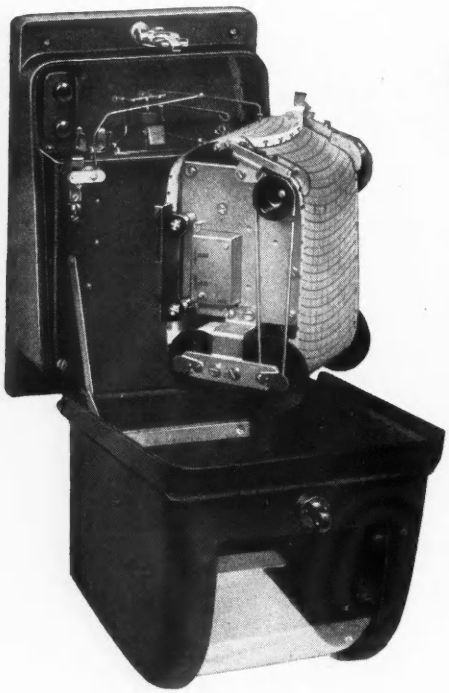

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ELECTRICAL REVIEW

6 May 1955 Vol. 156 No. 18 Established 1872

Freedom of Expression

THE free interchange of knowledge and experience is not merely an aspect of democracy, it is essential to the advancement of science and industry. Therefore anything which interferes with that freedom is to be deprecated and should be removed.

It is generally alleged that the public services are the most prone to restrict the dissemination of information. This may be true, but if it is what are the reasons? Let us look at the electricity supply industry. Before the industry was nationalized it was composed of over 600 separate units, of which about 370 were already publicly owned. In each municipal undertaking there was an engineer and or manager who was responsible only to a committee of laymen who generally were content to leave the conduct of electrical affairs to him. He was free to write to the Press or read papers before associations and institutions without fear of penalties—and he frequently secured advancement in this way. But were his subordinates always so free? Again, were the engineers and managers of company undertakings entirely at liberty to air their views in public, particularly when their undertakings were units in a group?

Suppose that the superiors in these cases were broadminded men who gave their juniors their heads: did those juniors feel entirely comfortable? Were they not sometimes apprehensive of committing indiscretions likely to retard their promotion?

When the industry was nationalized the number of "supreme" chiefs was very drastically reduced and former heads of undertakings became subordinate to chairmen of large Boards. They found themselves in much the same position as their former juniors and in many cases shared their apprehension of the possible results of too much freedom of speech.

Since nationalization we have been assured time and time again by the chairmen of the Central Authority and Area Boards that not only do they not want to prevent their people from writing for the Press, they desire to encourage them to do so. There has usually been a proviso that articles touching upon policy matters should first be looked at by those responsible for policy. On this point we may suggest that such scrutiny might not be necessary if the author made it quite clear that he was expressing his personal views—not his Board's.

In spite of the Boards' favourable attitude there still exists a reluctance, born of fears of possible consequences, on the part of the Boards' staffs to contribute to the Press. We feel that these fears are generally unfounded and we welcome a proposal that the Boards should assure their employees that such is the case.

It is only fair to add, in conclusion, that the employees of "private" industrial concerns are not entirely free from the inhibitions we have mentioned. There is scope here, too, for positive encouragement from managements.

X-RAY AND ELECTRON THERAPY

The 15 MeV linear accelerator which has recently been installed at the St. Bartholomew's Hospital Medical School, London, described elsewhere in this issue, represents a very great advance in electro-medical technique and science. In the first place the electron energy permits an X-ray output as high as 3,000 röntgens per minute at a distance of one metre, which is we believe many times higher than that obtained from any other radiotherapy machine, with the result that by the emission of very short bursts of very high intensity the effects of radiations can be much more quickly and accurately studied. Apart from X-ray therapy, however, the machine widens the possibilities of the newer sciences of electron therapy, in which the electrons themselves are brought out from the machine and used to irradiate tumours, and of neutron therapy which may offer new rewards because the effects of the passage of neutrons through tissue are in some ways unlike those caused by X-rays. We congratulate the St. Bartholomew's Hospital authorities on their courageous decision to confine the use of the equipment for the time being to research work in the medical school.

ELECTRIFICATION SUCCESS

British Railways last week announced some results which amply justify the optimism implicit in their £1,200 million modernization and re-equipment plan. The electrification of the Liverpool Street to Shenfield line in 1949 has had the effect of doubling the number of passengers carried. Since last October when electric traction was installed on the Manchester-Wath-Sheffield route both freight and passenger traffic has doubled and there has been a 137 per cent increase in the number of passengers carried on the Manchester-Glossop electrified section. Similar success has been experienced by the Lancaster-Morecambe-Heysham service where the 50 c/s system is being experimentally employed. Increased passenger traffic is also reported from the use of multiple-unit diesel trains. These results should encourage British Railways to go ahead as quickly as possible with their electrification plans in which the electrical industry is ready and able to co-operate.

EMPHASIS ON SELLING

With electricity consumption rising at a rate in excess of 10 per cent per annum—faster in fact than in most other countries—it might be thought that the industry's only preoccupation need be with building up generating capacity. As was shown at last week's E.D.A. conference, however, an all-out effort to sell more electricity, particularly where the load is largely off-peak, is both vital and urgent. Sir John Hacking, president of E.D.A., in opening the conference, stressed that in future capital charges in relation to running charges would be much greater than they were to-day, so that the improvement of load factor was of the utmost importance, and this aspect was dealt with at length by Mr. S. W. Hazell in one of the papers presented at the conference. Present conditions of full employment and large-scale building afford an opportunity to lay the foundations of the electrical way of life for the future and at the same time to benefit the industry by securing a greater diversity of load. We are undoubtedly passing through a period of social change and there is an insistent demand for modern labour-saving equipment for the home. Bearing in mind that once a new gas cooker or water heater, for example, is installed it is likely to remain in use for 10-15 years at least, it is essential that the advantages of electrical methods should be forcefully presented. Much good work is being done by Electricity Boards in persuading local authorities (sometimes with difficulty) to provide adequate installations, the lack of which is frequently a decisive factor against the extended use of electrical appliances. Moreover, the availability of grants for older, sub-standard dwellings has widened the field for development. New methods of space heating, such as floor heating and thermal storage, offer possibilities of an attractive off-peak load even in this direction. Unfortunately, for reasons of purchase tax, heaters of the latter type are not at present available for domestic purposes, but when the restrictions are removed, in the words of Mr. Hazell, "a contribution of the utmost benefit to the long-term economy of our industry can be achieved."

HEAT PUMPS

In this issue we give a short account of a domestic heat pump now available in this country for refrigeration and hot water heating, primarily the latter; and a rough calculation of the relative operating costs of this and a more conventional system. There can be no doubt that immense development in this type of apparatus will take place in the next decade. The convenience of centralized coal burning in power stations is combined with lower total fuel consumption and cost than with a direct solid fuel burning appliance in the home. In view of this it is regrettable that purchase tax should be levied on heat pump equipments (in the case considered the tax amounts to £53 out of a retail price of £175). These are fuel-saving appliances the adoption of which on a national scale should be helped in the same way as those burning solid fuel.

HONG KONG TRADE

Last year British electrical exports to Hong Kong were reported to have had a value of £1,802,000 which was appreciably less than in the two preceding years; in 1952 the figure was £2,500,000. This represents a small proportion of our total electrical exports (£170 million in 1954, according to the Board of Trade returns, but stated by the B.E.A.M.A. to be £218 million). While the scope for the sale of equipment in the Colony itself is restricted, Hong Kong is a centre for trade with China and other Far Eastern markets and it would be thought that there were wide opportunities for trade expansion. Although the power plant of the two electricity supply companies is British, other countries take a large share in the supply of consumer goods. An article on the opposite page surveys the present situation and gives some guidance to those who contemplate dealing with this market where there is promise of increased trade if and when relations with China are put on a more satisfactory basis.

WORLD ELECTRICAL MARKETS

Activities in Hong Kong

By G. W. B. HARRISON*

ALTHOUGH the Colony of Hong Kong is very small, only about 400 sq miles in area, a pinpoint on the map of the China coast, the terrain is far from ideal for electricity distribution. One of the popular residential areas is between 1,000 and 1,500 feet above sea level on the Peak of the Island of Hong Kong and the road up is very tortuous. Coal is not indigenous and the cooling (sea) water temperature rises as high as 86 deg F. Fortunately, Hong Kong does not suffer from earthquakes, but the regular occurrence of typhoons demands high safety factors in the outdoor construction of everything from the overhead distribution network to the neon signs for which Hong Kong by night is famous in the Far East.

From the Peak, the view by night of the shopping centres below sends visitors into raptures, and fascinates even the local residents, because of the hundreds of multi-coloured neon signs and brilliant street lighting. In the shopping districts there are probably 5,000 signs, both large and small, consuming about as many kW and employing, say, four times as many transformers. Flashing signs are prohibited by law. The Chinese language reads vertically and many of the signs are consequently upright arrangements projecting out from the walls. United Kingdom manufactured wire is used for the transformers, much of the rare gas is supplied by the local branch of a well-known United Kingdom concern, but an opportunity is believed to exist for the United Kingdom to improve its competition with the United States in clear and coated glass tubing.

The Colony of Hong Kong comprises many islands, as well as a small peninsula of the mainland of China. Most of the latter has 44 years of its 99-year lease still to run. The chief consumer areas are the Island of Hong Kong, which is ceded territory, and the mainland section. The generating and distribution authorities serving these two territories, which are separated by the harbour, are themselves entirely separate. There may be arguments for and against such an arrangement but one thing is certain, it does maintain healthy competition.

Evolution of Electricity Supply

The authority supplying the mountainous island of Hong Kong is a public company, the Hong Kong Electric Co., Ltd., incorporated in 1889. It was then awarded a Government contract to supply 50 street arc lamps and a pump to raise water to the Peak. In 1891 a contract was signed to light Government House and housing for the station staff was completed in 1892. The original station consisted of two 25 kW steam sets. In 1900, the company's records contain, for the first time, the now historic expression "the new engine and boiler were not delivered on time." By 1912 the generating capacity was 525 kW.

After an unsuccessful experiment in diesel generation, the company bought land on the foreshore and erected the present power station which opened in 1921 with two 1,500 kW sets; by the end of 1941 the capacity was 54,000 kW. After trying, unsuccessfully, to operate the station on wood, the Japanese occupying forces dismantled and removed some of the boilers and machinery. A recently laid feeder was then lifted and re-laid across the harbour to connect the Island of Hong Kong with the second electricity authority's plant which had by then been adapted for wood burning.

At the end of the war, the staff, released from 3½ years' unpleasant internment, faced an incredibly difficult situation: 19,000 kW of plant was available but in very poor condition; 20,000 kW was repairable, although so badly damaged that it took 18 months to bring the spares from the United Kingdom. The rest of the plant was either unusable or missing. With the help of H.M. Repair Ship *Resource*, limited re-operation began in October, 1945. In the face of advice from a British Government nominated consulting engineer to limit the load in the interests of safety, it was decided to accept the risk and take as great a load as possible. From that time to the present day, the company has, unfortunately, suffered from delayed delivery of plant from the United Kingdom.

The present load is about three times that prevailing in 1941. Among the company's largest bulk consumers are the Hong Kong Tramway Co., Ltd., the Taikoo Dockyard & Engineering Co., and the Dairy Farm Co. For half the year, the climate of Hong Kong is hot and very humid and the increasing popularity of air conditioning both for homes and offices represents a considerable load for the supply authorities. The popular window model has a ¾ h.p. compressor motor.

System Statistics

Following are some statistics about the present day operations of the Hong Kong Electric Co., Ltd.:—The distribution voltages are 6,600, 3-phase, 50 c/s and 346/200. During 1953 the kWh generated totalled 234 million kWh (7·8 per cent more than in 1952). A total of over 195 million kWh was sold divided between lighting 67,509,943 kWh, public lighting 1,148,993 kWh, bulk power 39,218,928 kWh, power and water heating 86,831,508 kWh and miscellaneous 536,973 kWh. Early in 1954 the peak load reached 52,600 kW. Rates of charge (subject to a 9 per cent fuel cost surcharge) are:—Lighting 15·4-28 cents per kWh; power 11·4-12 cents per kWh (special rates are available for bulk supply). (The Hong Kong dollar of 100 cents is quoted at 16 to the pound sterling.)

A new 30,000 kW power station is planned to be started in 1956 and completed by the end of 1958. Appropriate extension of the 22 kV distribution system has begun.

The company has 862 employees, 44 of whom are British. Since the war, a scheme has been approved for housing the majority of the workers in modern flats. The workmen and their families receive free medical attention and the company contributes towards the building and running of schools for their employees' children.

The other electricity authority, the China Light & Power Co., Ltd., supplies the 200 sq mile mainland section of the Colony. It is in this area that Hong Kong's sensational post-war industrial development has mainly taken place. All the cotton mills, still expanding, but containing at present 240,500 spindles, are situated in this area. The Colony's weaving capacity is about 6,000 looms. Other industries served by the Light & Power Co. include ship

* United Kingdom Trade Commissioner in Hong Kong.

An English Electric transformer for the China Light & Power Co.

yards, enamelware and flashlight factories and a brewery. The company started operations with a 400 kW 60 c/s diesel plant in 1901. In 1918, turbo-alternators were introduced; two years later the capacity was 3,500 kW and it had risen to 11,500 kW by 1926. In 1930 the frequency was changed from sixty to fifty cycles and the voltage increased from 110/200 to 200/346. In 1931 a 6·6 kV cable system was started in the urban area and a 22 kV network in the hilly rural part of the territory. For the latter, 0·75 sq in cadmium-copper conductors were used in long spans to take advantage of the mountainous terrain. Wooden poles are not allowed under the local electricity ordinance, presumably because of white ants and dry rot and, because of recurrent typhoons, a wind pressure of 40 lb/sq ft must be allowed for. Even so, flying debris, such as corrugated iron roofs, may, in typhoon weather, defeat the best conceived safety precautions.

In the rural areas, severe lightning storms are liable to smash complete insulator strings, as well as to disintegrate oxide film arrestors. Conditions have been improved by installing switchgear with a reasonably high-speed auto-reclose feature and experiments with arc gaps are in hand. Copper thieves have a habit of stealing the 33 kV conductors, using the ubiquitous bamboo pole to avoid electrocution.

By 1937, in a new building, a 12,500 kW set was installed together with a 120,000 lb/hr boiler operating at 400 lb/sq in and 750 deg F. A 20 MW steam set with appropriate boiler plant was ordered in 1941 but the outbreak of war forestalled its delivery. Post-war load recovery was slow and not until January, 1947, was the 10,000 kW figure reached and yet to-day a maximum demand of 59,400 kW has been recorded. The present station contains a 12·5 MW set and three 20 MW sets, as well as three 5 MW sets in the old station. A further 20 MW set is on order. Work on replacement of the original station is expected to begin within the next two years.

In 1953 the distribution voltage was changed from 22 kV to 33 kV and in the urban area the three major stepdown substations have full automatic voltage control on the 33/6·6 kV transformers. In that area transmission and distribution is by cable at 33 kV, 6·6 kV and 200/346 V. All jointing is done by local labour.

Consumers range from the one-light shack to a cotton mill with a maximum demand in excess of 3,000 kVA. One of the several arc furnaces supplied is rated at 1,800 kVA. All loads in excess of 400 kVA are supplied at 6·6 kV. Over 2,000 street lights, many of them of the h.p. mercury vapour type, are operated on behalf of the Government.

While on the subject of supply authorities, the Macao Electric Lighting Co., which serves the nearby Portuguese Province, may be mentioned. This company, using diesel sets, generates and transmits at 3·3 kV. The number of consumers is 18,337, with motors connected totalling 5,818 h.p. The maximum load is 3,311 kW.

Hong Kong Tramways, Ltd., which has been mentioned as one of the biggest customers of the Hong Kong Electric Co., operates 19½ miles of single track. The cars are of the double deck type so well known in England for many years. The gauge is 3ft 6in and the operating voltage 500 d.c. A daily service of 118 cars provides a tram every two minutes or less in each direction. 137 million passengers were carried in 1953, when the mileage run totalled 6,000,000. The flat rate fares are 20 cents (3d) first-class and 10 cents (1½d) third-class, and the maximum route length is 6¾ miles. Concession and monthly tickets are available.

Most visitors to Hong Kong take a pleasure trip on the Peak Tramway. Two rail vehicles operate the system, traction being provided by two steel hawsers on interconnected drums coming from the engine house near the top of the Peak 1,400ft above sea level. This tramway was opened in 1888 and to-day carries 1,800,000 passengers a year. The main haulage motor is of 220 h.p., and the length of each of the two hawsers is approximately a mile. The steepest gradient is 1 in 2. The electrical equipment was supplied by the Metropolitan-Vickers Electrical Co.

Another outstanding example of electric propulsion in the Colony is the two diesel-electric vessels of the Star Ferry Co., which operates the public passenger ferry across the harbour from the Island of Hong Kong to the mainland. Of all the company's very smart fleet, the electric vessels are probably the most attractive. They are doubled-ended, 110ft b.p. in length by 28ft beam. The propelling machinery consists of twin Paxman-Ricardo 12 R.P.H. type engines of 400 b.h.p. each coupled to a main generator of 190 kW (250 V d.c.), with an auxiliary generator of 50 kW (220 V d.c.) in tandem, all running at 1,000 r.p.m. The main generators supply current to the propulsion motors, of which there are two, one coupled to a propeller at each end of the vessel. Control of the propulsion motors is on the Ward-Leonard system, and is so arranged that when the vessel is under way, the forward propeller turns over at approximately 60 per cent of the speed of the after or driving propeller.

The auxiliary generators supply power for auxiliaries, lighting, and excitation of the larger machines. For use when the main engines are not required, a stand-by generator and compressor set is fitted. This consists of a Paxman 4 R.Q. engine of 40 b.h.p. (1,000 r.p.m.) directly coupled to a 20 kW generator (220 V d.c.), and there is a compressor in tandem, driven through a clutch. All the electrical equipment in the vessels was supplied by Metropolitan-Vickers. During 1953, the Ferry Co. carried over 36 million passengers in its fleet of six vessels.

Since 1949 the Kowloon (Hong Kong) to Canton (China) Railway has not run through trains; the British and the Chinese passenger rolling stock and the locomotives have travelled only as far as the frontier and then turned round. The British section of the railway is 22 miles of standard gauge single track. Steam traction has been used hitherto but two 1,125 h.p. diesel-electric GM12 engines are on order from Australia. These will be capable of being

driven from either end and have a draw bar pull of 36,000 lb. Delivery is to be made in July next which is within 18 months of the placing of the order.

Cable & Wireless, Ltd., is responsible for all the Colony's public overseas (including China) telegraph and radio-telephone services. More messages are handled per day and receipts are greater than at any other branch of the company's world-wide system.

Inland telephone service is provided by the Hong Kong Telephone Co., Ltd., an associate of the Oriental Telephone & Electric Co., in the United Kingdom. On March 31st, 1953, 29,779 direct exchange lines and a total of 44,329 stations were in operation. The system is automatic, of the 50 V Strowger type, and the company follows British Post Office practice. Distribution is almost entirely underground.

Extensive police radio networks are in daily use throughout the Colony covering police stations and posts, patrol cars and launches. Approximately 99 stations are regularly "on the air" and the equipment used is of the v.h.f. (FM) type supplied by the General Electric Co., Ltd. For emergency use in the divisions there are 98 stations consisting of equipment supplied by Amalgamated Wireless (Australasia), Ltd., Sydney.

The local broadcasting service—Radio Hong Kong—is operated as a department of the Hong Kong Goverment and provides about 150 programme-hours weekly in both English and Chinese. The technical functions are supplied by Cable & Wireless, Ltd., and the 2 kW transmitters provide good coverage on medium wave of the more densely populated areas of the Colony. The frequencies used are 860 kc/s for Z.B.W., the English station, and 640 kc/s for Z.E.K., the Chinese station, and 9·52 Mc/s (31 metre band) for Z.B.W.3 which transmits English and Chinese programmes at varying times throughout the day.

Rediffusion (H.K.), Ltd., is operating a wired system of broadcasting in Hong Kong, and a commercial broadcasting station operates in Macao, the Portuguese Province some forty miles west of Hong Kong.

Cable jointers at work in Hong Kong

Local Electrical Industry

Hong Kong has no heavy electrical industry. The principal field in which its electrical industry is developed is in the manufacture of flashlights. Over thirty factories are engaged in the production of the cases and a further eleven make batteries. The cases range from the very inexpensive to the highest quality models, some of which are produced for American companies using the American trade marks. Flashlight bulbs are made by half a dozen factories and the electric Christmas tree decoration light industry is rapidly developing.

Other smaller sections of the industry manufacture transformers (up to 500 kVA), fluorescent tubes and their starters, electric kettles, fires, fans and capacitors. Although not on the same scale as Hong Kong's well-known flashlight industry, the factories manufacturing starter condensers for fluorescent lighting constitute an interesting development. One of these factories alone produces four million condensers a month, the majority of which are exported to the United States. Some are exported in their impregnated state, others are impregnated and finished in the country of their destination.

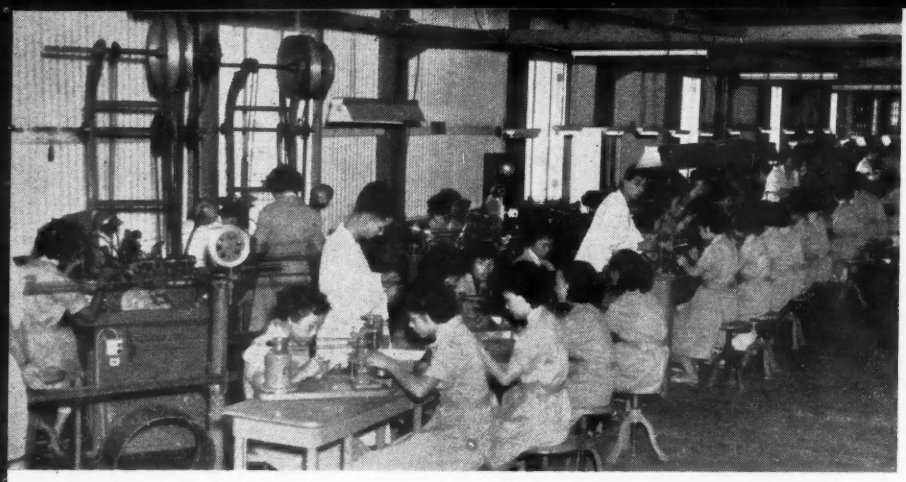
An electric clock factory is a recent addition to one of Hong Kong's principal engineering works. The clock department is in the new premises equipped with United Kingdom, Swiss and Japanese machinery. Movements for 50 or 60 c/s are produced. The assembly of the clocks, all components of which are made in the Hong Kong factory, is carried out in air-conditioned workshops. The factory is modern in design and well laid out.

The United Kingdom leads all other countries in the quality and strength of its representation in Hong Kong. Two of its leading electrical manufacturers have their own branches in the Colony. Two other equally important United Kingdom organizations have their own resident technical representatives. The great majority of the important British electrical manufacturers have agents in the Colony, most of whom have their own well-trained and experienced technical staffs. So far as the writer is aware, no competing foreign organizations have their own resident technical staff in the Colony, although many of the big concerns, both American and Continental, are well represented.

Because Hong Kong is a centre for trading with the mainland of China (as well as with other neighbouring countries, such as Formosa, Indonesia, the Philippines, South Korea and Thailand), there exists at the present moment not the same incentive for American concerns to station their own representatives in Hong Kong as there is for other countries whose Governments have less restriction on their trading with the mainland.

Fortunately the public utilities are almost exclusively the preserve of the British electrical industry. For consumers' requirements, however, international competition is acute. In price, and price is at present a prime consideration, Continental competition is the fiercest, whereas in styling which has particular appeal in the Far East, America sets the pace. The Chinese customer for domestic apparatus seems to favour the more flamboyant ultra-modern décor.

Competition in the domestic radio field is probably greatest from Holland, while in household equipment, particularly refrigerators, American sales are high. In the field of air conditioning and dehumidifying, America at the present time has almost a monopoly. The introduction of air conditioning in Hong Kong is still sweeping the Colony, in spite of the fact that a small exchange premium has to



Production of clock parts in the Chiap Hua factory, Hong Kong

be paid for U.S. dollars, which are bought on the free market, to purchase most domestic air-conditioning and dehumidifying equipment.

United Kingdom air conditioners are becoming more competitive both in design and price but although there is still great scope for the sale of additional equipment, particularly the small window-fitting units, the constant advances in styling, coupled with a downward price tendency, of the American equipment will continue to test severely our own design and production ingenuity. It is certain that local agents would be very pleased to act for British manufacturers of air-conditioning and dehumidifying equipment if apparatus comparable with the American equivalents in price, facilities and finish were available. There has been talk for some time of making the window units in Hong Kong from imported parts.

Most agents import on their own account but others import only against indents. Part of the demand is seasonal and delayed deliveries of certain items are often unsaleable. This applies particularly to fires and fans. Fashion as well as performance counts, and as soon as a piece of equipment, such as a radio set, has become outdated by the introduction of a new model, it is saleable only at a substantial loss.

The writer is forced to emphasize the necessity for abnormally good finish and styling in the domestic field in order to meet foreign competition. Hong Kong's climate is exceptionally humid and hot from about May to October. During the rest of the year it becomes cold enough for fires to be a necessity. For the summer weather, however, the fullest possible tropicalization is essential. Mould attacks almost everything. Packing, too, must be designed to resist this and the outer cases to resist the torrential early summer rains to which they may be submitted for a short time in transit locally.

In the Colony there are hundreds of retailers of domestic electrical equipment and two trade associations exist, viz., the Electrical Trade Association of Hong Kong and Kowloon, 38, Connaught Road, Central, 1st Floor, Hong Kong, and the Radio Dealers' Association, 46, Des Voeux Road, Central, 2nd Floor, Hong Kong.

Because of the quiet state of business by comparison with three years ago, when many of these shops probably opened, fixed prices are not the rule in the majority of retail establishments. A proportion of the retailers will to-day conclude a sale at a profit so small that no British trader would dream of accepting it. This hardly makes for good after-sales service. To-day's small profits are compensated for to some extent, in times of prosperity, by taking advantage then of any profit which the state of the market will bear. Even the merchant who imports on his own account is to some extent influenced by the same considerations.

Sole agency commissions on domestic equipment, where they are granted, range from 5 to 10 per cent and an importer who is buying for stock would operate on anything from 10 to 25 per cent margin, depending on his overheads, including service charges, whether the stock is fast-moving and whether it is likely to date quickly in the Hong Kong market. The Colony possesses a number of agents as good as can be found anywhere in the world. Principals and agents undoubtedly benefit if the former give the latter their continual and close support. Any other arrangement tends towards price cutting and confusion.

The Chinese is a great man for combining personal friendship with shrewd business ability. He reacts very favourably to personal approach either in correspondence or preferably by visits from the senior sales staff of overseas exporters. A visit to the Colony to appoint an agent will usually be rewarding. It may sound superfluous to make such a remark where the United Kingdom is concerned, but the worst fault of which an exporter can be guilty is to give an impression of thinking that Hong Kong is the " back of beyond." With its free currency market, Hong Kong has a choice of the world's most up-to-date and advanced products and nothing in any way defective or poorly finished is suitable for this market. An additional reason is that the slightest defect in any product, even to a minor chip of enamel, constitutes a bargaining point on which a customer expects, and will often receive, a price reduction.

The technical qualifications of agents are usually adequate and in many instances high. However, at the present moment the University of Hong Kong has a civil, but neither electrical nor mechanical engineering faculties. If it were to introduce electrical engineering courses, it might well produce more qualified engineers than local industry and trade could absorb but this would at least have the advantage of raising the general standard of technical ability in the trade. Good technical schools are producing very able mechanics with a sound basic theoretical knowledge.

The standard of courtesy in Chinese retail shops of all descriptions is noteworthy and this is exemplified in the retail electrical trade by the trouble to which the shopkeeper will go to round off a sale pleasantly. It is no trouble, in fact it is an obvious pleasure, for him to fix a flex and plug to domestic equipment. It has in the past been a defect of some United Kingdom electrical domestic equipment that the flex supplied has been uselessly short. Particularly in European homes in the Far East, large rooms have for many years been customary because they promote better ventilation and comfort in hot weather. These large rooms invariably call for long flexes on toasters, fans and electric fires; s.b.c. lampholders are normal.

One wholesale customer in Hong Kong of whom special mention must be made just now is the China Resources Co., 12th Floor, Bank of China Building, Hong Kong. This agency purchases on behalf of the China National Import Export Corporation, whose headquarters are in Peking. Local agents are usually in touch with this organization and its import manager is always willing to meet British business men who are visiting the Colony. This provides an opportunity to discuss with this organization those of one's products which are available for sale to China and to leave literature and tentative prices with the China Resources Co. in case it should receive an inquiry from the mainland for the commodity concerned.

An Electron Accelerator

New 15 MeV Linear Equipment at St. Bartholomew's Hospital, London

ON 27th April H.R.H. the Duke of Gloucester inaugurated a 15 million eV linear accelerator which has been acquired by the treasurer and governors of St. Bartholomew's Hospital, London, from their endowment funds and installed initially in the Medical College for purely research work.

Athough the treatment of cancer with the high energy X-rays generated in the linear accelerator is one of the chief objectives of this machine, plans have been made to investigate two new techniques which are possible with this accelerator. One is electron therapy, in which the electrons themselves are brought out from the machine and used to irradiate the tumour. Electrons of an energy of 15 million eV can penetrate to a depth of 3in in tissue, and there are definite advantages in using such electrons, chiefly due to their finite range of penetration. The other possibility is neutron therapy. The bombardment of uranium with electrons gives rise to a copious emission of neutrons. The effects due to the passage of neutrons through tissue are in some ways unlike those caused by X-rays, and the results of neutron therapy may therefore be quite different. In addition, it may be possible in certain cases to localize the therapeutic action of the neutrons in definite regions of the body. Above all, however, it is intended to use the linear accelerator as a tool for fundamental research into the action of radiations on living tissue. It is the first large size equipment to be devoted to full-time research in radiobiology.

The linear accelerator is a device to accelerate electrons so that they acquire a very high kinetic energy. Although at the end of their run the electrons have the same energy as they would have had after passing through a potential difference of 15 million V, no such high voltages are employed, the highest voltage being only 50 kV. The acceleration is achieved by means of a radio wave which is made to travel along a 20ft long tube, the so-called waveguide, which is the heart of the machine. The velocity with which the waves travel can be varied, and is arranged to increase, by means of corrugations, or diaphragms, placed at intervals inside the waveguide.

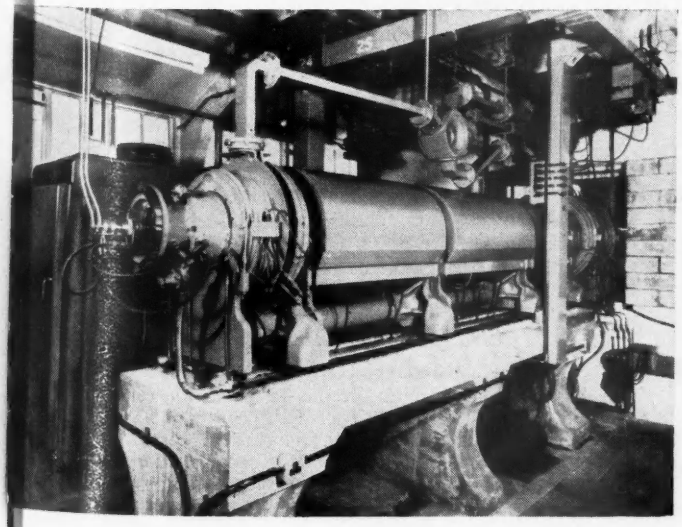
The electrons are produced in the "gun," in the same way as in an ordinary X-ray tube or radio valve, by heating a tungsten filament to a high temperature. The 50 kV applied to the gun accelerates the electrons to a velocity of about two-fifths of the velocity of light. The radio wave in the guide, near the gun end, is made to travel with the same velocity, so that the electrons entering the guide are carried by the wave and ride on it in much the same way as a surf rider is carried by an ocean wave. The increasing speed of the wave causes the electrons to move faster and by the time they reach the other end of the tube, which takes only about one forty millionth of a second, the electron velocity is 99·95 per cent of the velocity of light.

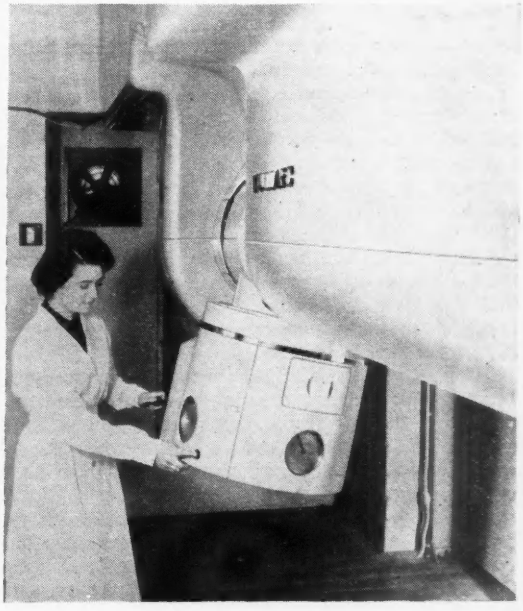
The radio waves are generated in a magnetron, a special high-powered valve which generates high-frequency radio waves in pulses of very short duration; these pulses can be repeated at any frequency from 100 to 500 per second. The electrical power in the pulse is very high, about 2,000 kW, and about 40 per cent of this can be delivered to the electron beam. The linear accelerator is thus the most efficient of all accelerating machines.

The chief parts of the accelerator are: the modulator, in which power from the a.c. mains is transformed to produce high-voltage pulses for the magnetron; the magnetron, which produces the radio waves at a frequency of 3,000 Mc/s; the rectangular waveguide, by means of which the radio waves are transmitted from the magnetron to the corrugated waveguide; the gun, which is the source of electrons; the corrugated waveguide, in which the

Right: The X-ray head

The accelerator has initially three sections, the electron gun, the rectangular waveguide and the magnetron and modulator





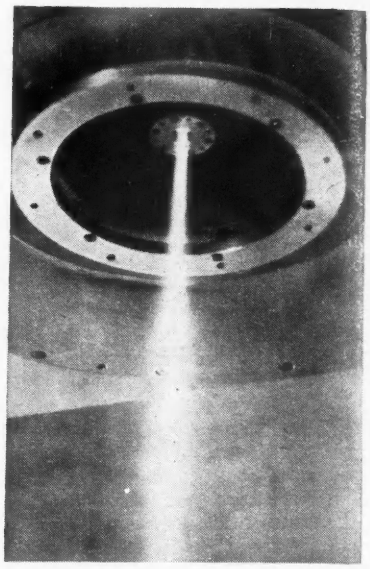
electrons are accelerated; the focusing coils, which produce a magnetic field in the corrugated waveguide, and compel the electrons to travel along the axis of the guide; the vacuum pumps, to reduce the pressure inside the guide and so prevent the electrons from being lost through collisions with gas molecules.

In the accelerator the electrons travel in a horizontal direction. For therapy purposes, however, it is desirable to direct the radiations at the lesion from different angles. To make this possible, as well as to provide other facilities required for treatment, an extra piece of equipment, the X-ray head, is attached to the end of the accelerator. The head contains a magnet by means of which the electron beam emerging from the waveguide can be bent through a right angle. In addition, the whole head can be rotated through an angle of 140 deg, so that the radiations can emerge in any direction from 20 deg on one side of the downward vertical to an angle of 30 degrees above the horizontal. For experimental purposes the electron beam can also be made to emerge in the straight through direction, without being bent by the magnet.

In order to be able to select different types of radiation the X-ray head contains a target holder which can be put in any one of three positions. In the first, there is no target, and the electrons emerge directly into the air. In the second, they are made to strike a platinum disc, resulting in the production of an X-ray beam. In the third, they strike a uranium cylinder and the X-rays produced give rise to the emission of fast neutrons.

The X-ray head also contains various ionization chambers, i.e., devices to measure the intensity of electrons and of X-rays. Some of these are so arranged that they control automatically the energy of the emerging radiations and ensure that the X-ray beam maintains its direction. The size of the emerging X-ray beam can be varied by means of motor driven lead irises; the aperture of the beam is rectangular and at a distance of one metre it can be varied from zero to an area of 20×28 cm.

Normal photograph of electron beam from accelerator



The accelerator can be operated from either of two positions: the physicist's control desk or the radiographer's control desk. The former contains a number of meters as well as a cathode ray oscilloscope by means of which one can see at a glance the state of the various parts of the machine. This desk is intended to be used only for starting up the accelerator and for the initial tuning. For routine operation the radiographer's control desk is employed. This is situated at a greater distance from the machine and contains only those controls which are necessary for normal running of the accelerator.

A contract was placed with Philips Electrical for the machine to be built at the Mullard Research Laboratories.

Organization and Methods

PRESIDING at a meeting of the Royal Institute of Public Administration on 25th April, Mr. Ernest Long, secretary of the Central Electricity Authority, maintained that organization and methods systems were no novelty. He was able to cite an article published as long ago as 1905 in *The Secretary* in which the writer emphasized the need for a study by senior administrators of the principles of "method and organization."

The evening speaker was Mr. E. F. L. Brech (Urwick Orr & Partners, Ltd.), who spoke of the danger that senior executives might feel that, having established an O. and M. system, they could sit back and leave the question of efficiency to the experts. In fact, the promotion of efficiency was inherent in the tasks of management.

The growth of large-scale undertakings, particularly those under public control, had led to increasing attention being given to organizational matters, but it was still the case that O. and M. experts devoted too much thought to method and not enough to organization—the more difficult part of their function.

Speaking of some of the tools of management, Mr. Brech gave particular attention to forms. Here he saw the danger that a form might be designed with a view to abstract efficiency and without regard to the user. Forms must, for instance, be easy to read and understand, for otherwise time would be lost by those who handled them.

Mr. Brech attempted the difficult task of distilling the principles on which the tools of management should be designed; it was difficult, he said, because of the number and variety of the fields with which management was concerned, but he suggested that there were a few general considerations. First, standards of performance must be established and actual achievements compared continuously with those standards. Then the purpose of every tool or instrument used by management ought to be kept in mind; Mr. Brech seemed to refer to the danger that tools might become obsolete and continue in use, as it were, by mere administrative momentum. Thirdly, methods of simplifying and specializing work should constantly be sought for, and finally, the man or woman who would actually use the tool should never be forgotten. Each problem had to be handled in the light of its own special characteristics; methods that had proved successful on one occasion would not necessarily succeed on another.

Mr. Stevens (Central Electricity Authority) raised with Mr. Brech the question of putting into operation a decision, taken at top level, to conduct an organizational inquiry against the antagonism or indifference of those at a lower managerial level. Mr. Brech said that the O. and M. staff should be associated with the highest executive authority in the organization and it was the task of that authority to see that it won the co-operation of all subordinates.

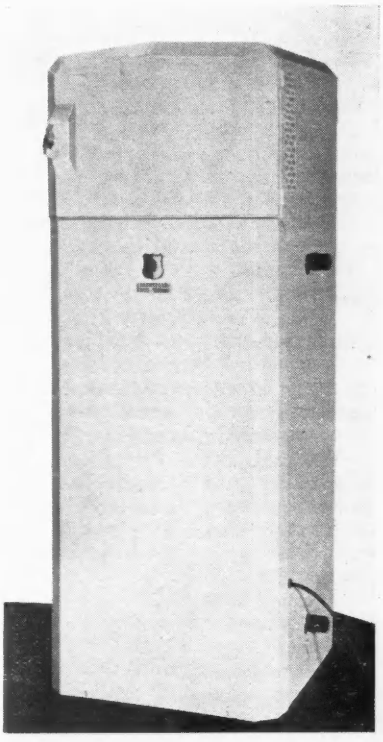
I.E.E. South Midland Centre

A joint summer meeting of the I.E.E. South Midland Centre, the Rugby and North Staffs Sub-Centres, the Supply and Utilization and Radio Groups, and the Students' Sections of the Centre and Sub-Centres and the Education Discussion Circle will be held on 15th June when a visit will be made to Nottingham.

Domestic Heat Pump

THE past few years have seen much speculation and many optimistic predictions concerning the possible future and economics of heat pumps used in domestic premises. In the last few months two units have been made commercially available to the public. The Ferranti model, meant for use in conjunction with a conventional plumbing system, was displayed at the A.S.E.E. Electrical Engineers' Exhibition in March; and visitors to this year's B.I.F. will be able to see the Brentford Electric "Duo-Therm" heat pump exhibited on the D.S.I.R. stand.

The "Duo-Therm" has been primarily designed for building into a new house and incorporates its own 30 gal copper cylinder which complies with all water board requirements. It is meant to stand in a larder, extracts low grade heat from the air in the larder, replenished by ventilator from the outside, and thus keeps the larder at a constant coolness. Above that part of the cabinet housing the compressor and tank is a $2\frac{1}{2}$ cu ft refrigerator of the normal type, including facilities for ice making. This, in conjunction with the continually cool larder, would seem to provide all the refrigerating facilities in the normal household. Ice is made after operation for about a quarter of an hour.



Brentford domestic heat pump

The compressor, a sealed unit incorporating a $\frac{1}{3}$ h.p. motor, is normally operating continuously, for should it stop a reversal of the cycle would result in the rapid defrosting of the refrigerator part. Hot water at 140 deg F is produced at the rate of 4-5 gal/hr. To prevent shutting down of the compressor when the whole tank is hot, a heat leak in the form of either a heated towel rail, or an airing cupboard radiator is provided together with an automatic valve which causes it to cut in and out according to the needs of the system. A thermal cut-out at the bottom of the tank shuts off the compressor motor if the radiator has not operated. The coefficient of performance, obtained on starting with the water in the tank at 55 deg F is about 3·7, dropping to about 3·5 at 90 deg F and 2·0 at 130 deg F. Experiments have shown that a larder of about 120 cu ft capacity is desirable.

The Brentford heat pump costs £175 which may at first sight seem high relative to the household hot-water systems normally installed to-day. We have made our own comparison of the two systems and the results are summarized in the table. To obtain the true equivalent in capital cost we have allowed £23 for a modern thermostatically controlled boiler of about the same output, £10 for associated building work and flues, £12 for a tank, £45 for a refrigerator of about the same capacity and £6 for an immersion heater. The total achieved is thus £96 for a system commonplace in modern houses.

It will be seen that taking 10 per cent annually for depreciation and maintenance the cost of the heat pump works out slightly less than that of the conventional system. If 5 per cent were taken the figures would be still more in its favour, but in practice it is not easy to assess a probable life for the compressor unit, running full time. Routine maintenance would certainly be less than with a boiler but when trouble occurred it would probably be more expensive. For purposes of calculation we feel 10 per cent is a not unreasonable figure for both. It is common for immersion heaters to be used in the summer months but not for as much water as in winter for weather reasons as well as for obvious financial ones. The heat pump has to continue at the same production rate, needed or not, for refrigeration to continue. Kitchen heating would certainly be necessary if a heat pump were used, as a certain cooling effect on the kitchen would seem an inevitable result in addition to the loss of the space heat obtained from the average domestic boiler.

Financially, the pump shows a slight advantage; also more hot water is available in summer if required, and a cool larder is a by-product. No stoking, coke storage or coke delivery troubles exist. In our examination so far, however, we have omitted all mention of purchase tax. Of the £175 purchase price of the heat pump, about £53 represents tax, presumably on the basis that it is a refrigerator. In fact, it is a fuel saving appliance of remarkable convenience and is a more efficient user of the nation's fuel resources than the domestic boiler, which is exempt from tax: the effect on the economic comparison above of omitting £53 in the capital cost of the heat pump will be readily appreciated.

	Heat Pump	Conventional System
Capital cost	£175	£96
Weekly hot water output	800 gal	800 gal for 8 months 400 gal for 4 months
Weekly cost with coke at 8s/cwt and elec. at 1d/kWh	4s 8d	8s for 8 months 11s 6d for 4 months
Kitchen heating	6 kWh/day over 6 months average of 1s 9d/week	Not required
Running cost of refrigerator	Nil	8d/week
Total weekly running costs	6s 5d	10s 5d average
Annual cost—	£ s d	£ s d
Depreciation and maintenance at 10 per cent	17 10 0	9 12 0
Running costs	16 13 8	26 1 8
	£34 3 8	£35 13 8

Automatic Circuit Reclosers

Use on Rural Overhead Lines Discussed

THE discussion on the paper entitled " Automatic Circuit Reclosers " by Messrs. G. F. Pearson, A. H. Pollard and N. Care, which was presented on 27th April before the Institution of Electrical Engineers' Supply Section, was opened by Mr. C. H. Flurscheim (Metropolitan-Vickers) who believed the paper to represent a real contribution to the continuity of supply of electricity. Less effective protection was provided elsewhere than in the Midlands with worse continuity of supply at lower cost. The automatic recloser offered better protection and added security at remote points. The weight-operated recloser was more accessible for rewinding near the substation. If the protection was not good enough, a relay could be fitted without excessive complication.

Mr. G. O. McLean (South Western Electricity Board) expressed surprise at the authors' preference for the lock-open recloser. The hold-closed type made co-ordination easier; one had only to co-ordinate fuse against fuse and not fuse against recloser. He thought the authors had not gone far enough on sectionalizers; theirs, seemingly, could not count past two, whereas a count up to at least five or six was required.

Mr. O. M. White (Balfour Beatty) was impressed by the analysis of faults which covered nearly every contingency. He asked whether skilled maintenance was required and whether the possibility of using these reclosers for the protection of series condensers had been considered.

Mr. K. M. Jones (British Thomson-Houston) drew attention to the possibility of using arc suppression coils in connection with phase-to-ground faults. Sectionalizers, which were used widely in America, had troubles of their own, particularly with high impedance faults. He then described a timing unit for testing protection in breakers developed by his company in co-operation with the City and Guilds College.

Mr. R. A. Woods (Southern Electricity Board) thought most distribution engineers would agree that there was a good case for more auto-reclosing on distribution networks. The real point was the type to be used. The authors had made out a good case for the high-speed type, but whether hold-closed or lock-open, was still a matter for debate. He thought the 50 and 30 A reclosers more suitable to conditions in this country than the 15 A rating.

Mr. A. C. Gibson (British Thomson-Houston) said that of the two types of American recloser, the porcelain-clad and the dead-tank type, the dead-tank type had been chosen for the British unit, so as to permit of simple interconnection of phases to provide three-phase tripping. The inter-tripping of porcelain-clad units by insulation members only would be extremely difficult.

Mr. R. H. Golde (E.R.A.) objected to the term " permanent interruption " in view of its possible effect on consumers. He preferred " persistent interruptions." The authors' claim for the number of transient supply interruptions avoidable by the use of auto-reclosing breakers seemed on the safe side. A large number of transformer failures started as transient faults. The introduction of the auto-reclosing breaker would also lessen the number of persistent faults.

Mr. E. Hywel Jones (S. Wales Division, C.E.A.) referred to a small water power station with three sets feeding into the Area Board system. It would be serious if they continued to generate in face of the operation of auto-recloser protection. Was there a cheap method of retaining stations of this type in use?

Mr. J. E. Peters (North Western Electricity Board) asked whether maintenance would be carried out *in situ* or at a depot. A shorting switch and isolators to make the device dead would add to the cost and make it more difficult to justify reclosers economically.

Mr. P. E. Gaze (British Thomson-Houston) pointed out that experience of this new device was limited and urged users to supply manufacturers with the maximum possible amount of information on their experience.

Mr. R. Mallet (Midlands Electricity Board) felt there was a strong case for unearthed tanks, particularly with B.S. 1320 lines, where the recloser might introduce a point of weakness. He saw difficulty in adopting live-line maintenance technique. The necessity for shorting out the switch did not really arise because a short jumper could be put across the live line and the reclosers could be lowered for maintenance.

Chemistry Research

THE annual report of the Chemical Research Laboratory of the Department of Scientific and Industrial Research (H.M. Stationery Office, 3s)—describes the wide range of investigations carried out at the Laboratory during the year. Corrosion of metals presents industry with one of its most costly problems. To assist in surmounting these difficulties the Laboratory is engaged on an extensive study of the causes, mechanism and prevention of corrosion in immersed, underground and atmospheric conditions. The extent of the field is demonstrated by the number and variety of inquiries dealt with and described in the Report. Many inquiries concern corrosion by sea water. These range from the protection of telephone repeater units to that of the reinforcing metals in a concrete sea wall.

Much attention has been given to the use of ion-exchange resins possessing specific selectivity for particular metals. Quantitative separations of copper, cobalt, nickel and iron have been made from solutions using an organic solvent mixture to remove the metals from the resin. Columns of ion-exchange resins can be used for the recovery of valuable minerals. A pilot plant of this kind is now operating in Southern Rhodesia for the separation of gold and other metals from cyanide solutions. Ion-exchange resins can also be used as membranes in an electrolytic cell because they form a barrier to the passage of one ion whilst allowing the other ion to pass. Separation of ions is thus brought about. By using cationic and anionic membranes in combination a variety of separations can be effected.

The Laboratory has played an important part in the discovery of a new source of selenium. Sludges deposited during the purification of sulphur dioxide from the flash-roasting of pyrites can be rich in selenium. As much as 60 per cent of selenium has been found in some of these sludges. The Chemistry Research Board strongly recommends that these sludges should be processed in Britain for their selenium content and suggests that if this were done it would be possible to obtain maximum recovery of the element by having pyrites with the largest content of selenium directed to plants where the sludges are produced.

Scientific Instruments

Survey of the Physical Society Exhibition

By P. L. DEGEN

THIS year, for the first time in its long history, the Physical Society's annual exhibition of scientific instruments was not held in the Imperial College of Science and Technology but instead in the New Hall of the Royal Horticultural Society, Victoria. In place of the agreeable though sometimes exasperating sprinkling of stands and exhibits over four floors and numerous laboratories and corridors, the whole exhibition was laid out in a single large hall. However, the exhibitors were, in the main, the same, and the high standard of previous years was maintained in the exhibits.

The exhibition was opened by Professor R. Whiddington, C.B.E., M.A., D.Sc., F.R.S., on Monday, 25th April, and closed on Thursday afternoon, 28th April. On Monday evening Mr. M. E. Haine (A.E.I., Aldermaston) gave a discourse on "The Free Electron as a Tool in Scientific Research." Apart from the obvious case of electronic equipment generally, the free electron is utilized in a variety of experimental and research techniques, the scope and limitations of which Mr. Haine reviewed.

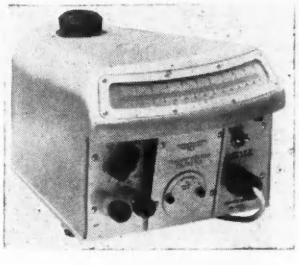
Professor J. Z. Young, F.R.S., of the Department of Anatomy, University College, London, discussed "Memory Systems in the Brain" and postulated a model of the formation of a memory of an event or visual stimulus. On Wednesday, Dr. G. F. J. Garlick (University of Birmingham) discussed "Recent Developments in Luminescence and its Applications." Cathode ray tube screens, fluorescent and electro-luminescent lamps, infra-red image convertors and scintillation counters are only some of the industrial applications of phosphors. Research in fields such as the growth of single crystals, and studies of the optical and electrical properties of phosphors are fundamental to the improvement of attributes required by the user, such as phosphor efficiency and stability.

The instruments shown were again predominantly electrical or electronic, even when the quantities measured were not themselves electrical: thus one instrument measures the thickness of conducting materials by means of a variable-frequency oscillator and a quartz crystal transducer which sets up ultrasonic vibrations in the specimen. The frequency is varied, and at resonance increased power is drawn from the oscillator: a pip on a cathode ray tube trace indicates the frequency, and hence the thickness. Another instrument with cathode ray tube presentation is a valve characteristic tracer, which displays a family of I_a: V_a curves against an electronically generated graticule which is fed via electronic switches to an amplifier common to the curve tracing circuits, thus giving a calibration independent of amplifier linearity and stability. Anode currents and voltages of 2 to 500 mA and 50 to 500 V, and up to 25 W anode dissipation are within the capabilities of the instrument. A pen-on-paper trace is obtained from another instrument, which plots one, two or three variables Y against one or two variables X which are available as signal voltages. The accuracy is better than 0·2 per cent.

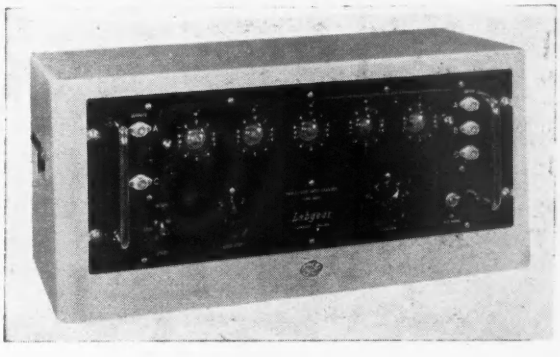
Cathode ray oscillographs were present in all sizes up to large console units. One such has provision for six additional sub-units to extend the performance of the instrument to meet specialized requirements. The Y amplifier bandwidth is from d.c. to 25 Mc/s, and the tube has variable e.h.v. supply, giving a 10 to 1 control ratio of deflection sensitivity, while the timebase circuit allows a series of compressed waveforms to be displayed, from which a small section is selected and transferred to the normal sweep for display and measurement. Another large trolley-mounted oscilloscope is intended for high frequencies, fast rising transients or low repetition rate pulses. The triggering circuits are capable of responding reliably to waveforms of great variety, of either polarity and amplitudes down to 0·2 V. On the same stand a system of sub-units of modular dimensions was displayed: there are bolted together, coupled with a single, double or four channel cathode ray tube unit, and electrical connections are made to give many oscilloscope assemblies which can be bench or trolley mounted. Another trolley-mounted instrument includes a 35 mm camera with a $f/1{\cdot}0$ lens enabling a time interval of 0·001 μs to be resolved after moderate photographic enlargement; a twelve-channel oscilloscope with thirteen tubes and continuous-feed camera recording was not shown owing to limitations of space.

Numerous exhibitors showed new models in more familiar sizes: wide bandwidth in the Y amplifier from d.c. or a few cycles per second to 10 Mc/s or higher is common, and provision for injection of time calibration pips into the trace is widely available. One transportable oscilloscope is designed for displaying pressure, strain and vibration: it is intended for use with a wide variety of transducers, and incorporates facilities for energizing resistance strain gauges. Cathode ray tubes shown included a 4in tube capable of use up to 100 Mc/s, and a wide range of flat-faced tubes, some of square form.

The bandwidths of amplifiers exhibited varied between 100 Mc/s and 1·5 c/s. At the one extreme were two distributed amplifiers: a single stage version giving a gain



Suspended-coil voltmeter with resistance of 1 MΩ/V



Triple gate pulse ratio counter

of 12× and a two-stage model with a gain of 25×, each of which has a substantially flat response from 1 kc/s to 100 Mc/s. The two can be coupled together to give an overall gain of 300×. At the opposite extreme was a range of high-gain amplifiers for use with vacuum thermopiles, a " chopper " interrupting the radiation incident upon the detector. In this case the frequency is 20 c/s and the bandwidth 1·5 c/s: the gain is 5×10^7. Another amplifier for a similar application feeds to two corners of a diode bridge, the remaining corners of which are fed by a reference signal derived from the " chopping " system. The phase of this signal is such as to short circuit the amplifier output during interruption of the beam of radiation: consequently the bridge acts as a half wave rectifier for the signal. Random noise, however, will not be of the same frequency, and will be passed by the bridge as a.c. The d.c. signal is averaged by a ladder-type R.C. integrator, while the noise is lost.

Several stands showed digital and analogue computors or components for them. One medium size digital computor is built up from standardized plug-in units for ease of maintenance and replacement. A small table-top analogue computor capable of solving linear simultaneous differential equations is furnished with ten amplifiers having a gain of 1,500 and a bandwidth of 12 kc/s: the solutions are displayed on a cathode ray tube. Another instrument is intended for the computation of auto- or cross-correlation functions of data in the form of line records on film or paper, by means of photoelectric line followers. Many other computing functions can, however, be performed.

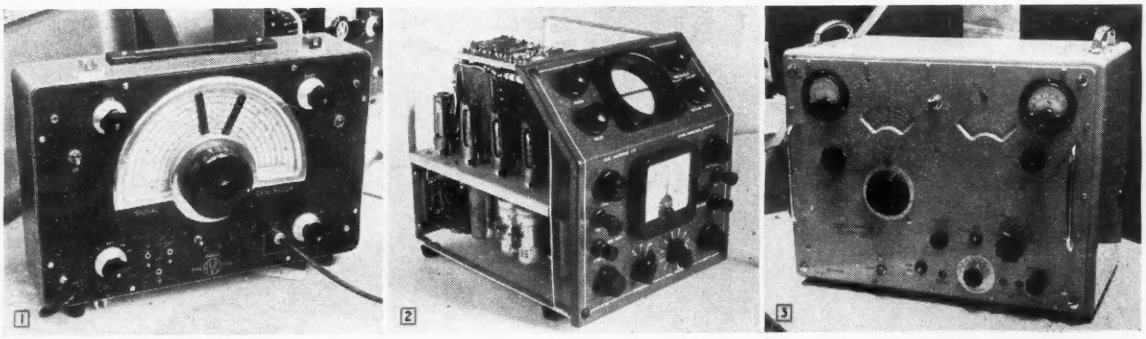
Influence of Transistors

Highly " miniaturized " components are becoming increasingly necessary as transistors become more widely used: several stands had examples of this. Impedance levels, d.c. potentials and power dissipation are very much lower than in analogous thermionic valve circuits and advantage can be taken of this in designing the components. Thus miniature transformers of unconventional configuration were shown, less than a quarter of an inch thick; a magnetic amplifier smaller than a matchbox, an encapsulated transistor oscillator h.v. generator less than 1½in square and only ½in deep, and volume controls and switches contained within the knob itself. Elsewhere, transistor d.c. convertors of very small size were shown, the transistor connected in a relaxation oscillator circuit chopping the low voltage current. Power junction diodes were shown, from diodes in a bridge circuit giving 50 V and 20 A.

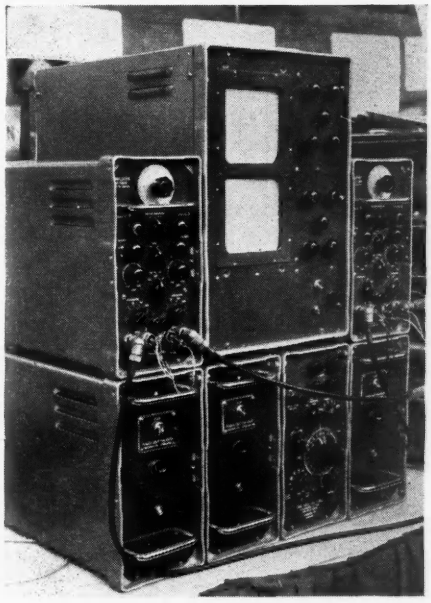
In the field of very high frequencies, a klystron oscillator was shown for frequencies between 33,300 to 37,500 Mc/s. The millimetre-band components (oscillator, output meter, attenuator and frequency measurement) are in one section, whilst power supply, modulation system and frequency stabilization circuits are contained in a separate cabinet, which forms a versatile power supply for most currently available klystrons.

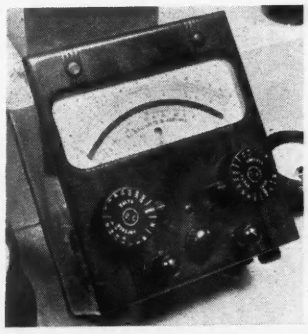
Oscillators and signal generators for lower frequencies were numerous. The instrument covers the decimetric range from 300 to 1,000 Mc/s with a frequency calibration accuracy of ± 1 per cent and short-term stability of 0·1 per cent. Another instrument has an output variable from 1 μV to 100 mV between 10 to 300 Mc/s. A signal generator covering the range 30 kc/s to 30 Mc/s in seven ranges has a film drive giving a scale length of 48in, and a crystal calibrator. Another wide-band signal generator provides a carrier at frequencies from 5 to 225 Mc/s which can be modulated with 30 per cent sine or square wave at 1 kc/s, or frequency modulated at 1 kc/s between 80 and 100 Mc/s. A 1 kc/s signal is also available, and the accuracy of frequency calibration is 1 per cent. Another signal generator covers the range 10 to 500 Mc/s and provides a calibrated output variable between 0·1 μV and 2 V; between 0-90 per cent 1 kc/s sine-wave amplitude modulation can be applied, or external modulation from d.c. to 3 Mc/s at maximum carrier frequency. A compact, transportable f.m. signal generator covers the range from 19·7 to 102·5 Mc/s in five bands with high frequency stability: the output is variable between 0·2 μV to 200 mV by means of a precision piston attenuator.

An audio frequency signal generator covering the range 10 c/s to 110 kc/s was displayed in conjunction with a pulse/square wave generator which converts the sine wave into pulses of 8 mμsec rise time, and a pulse height valve voltmeter which measures pulses of either polarity independent of pulse width and repetition rate. Among other pulse-measuring equipment shown was a rack mounted pulse height analyser. This instrument sorts incoming pulses into 60, 80 or 120 groups according to their voltage amplitude. A random sample of pulses is counted and a maximum of 1,200 binary digits equally divided between the channels can be stored in the memory system. The pulse spectrum is plotted in the form of a histogram on semi-logarithmic axes on a cathode ray tube display. In another instrument the pulse counts of three sources are compared: the equipment comprises a counter and three hard-valve electronic gates, and is connected to two ordinary counters for operation. The three gates are simultaneously opened, and can be closed when the count for any of the three sources reaches a convenient power of ten, whereupon the ratio of pulse rates for the other two sources can be directly read off. On the same stand was a time period counter which measures the time between two events in the range 100 μsec to 10 sec which can be extended to 10,000 sec by the addition of a dekatron register. Another interval timer covers the same range: the accuracy claimed is 0·005 per cent ± 10 μsec.



1.—Wide band AM/FM signal generator. **2.**—*E.M.I. general purpose oscilloscope type W.M.1.* **3.**—*Signal generator for range 300—1,000 Mc/s*





Large multi-range test set (shown in "Perspex" case to reveal construction)

Cathode ray oscillograph assembled from modular units

New models of voltmeters, ammeters, etc., were, of course, on show. Improvements were generally in details of construction, reduced size, protective sealing and "ruggedization" (if this barbarous term is to be admitted). Wide scales up to 270 deg and 300 deg were shown: one range of moving-iron instruments incorporated fluid damping, and another manufacturer showed a range of 260 deg moving iron and induction meters, and a simple and effective method of illuminating the scales of small panel mounted instruments. An induction type wattmeter for use on unbalanced three-phase four-wire systems had a 300 deg scale. A differential a.c. current meter measures the difference between two a.c. currents by means of a network including two rectifiers and a centre-zero movement. Maximum possible sensitivity is 1 to 5,000. A frequency meter unusually independent of waveform and voltage is based on two double-T bridges. The rectified outputs of these are in opposition, and the moving-coil meter indicates the balance position of the d.c. bridge formed. A range of taut-suspension galvanometers with built-in lamp and scale included a voltmeter with a resistance of 1 MΩ/V and ten ranges from 10 mV to 300 V.

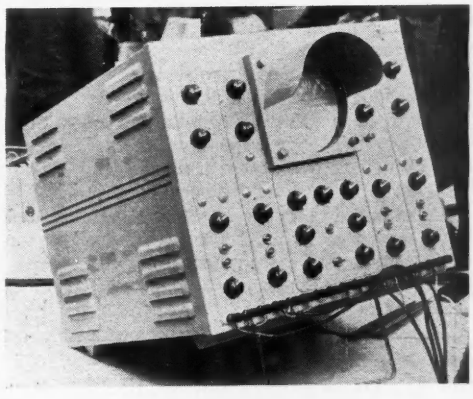
A well-known valve characteristic meter appeared in a new presentation: an attractive new case affords increased protection to an instrument of increased versatility and improved accuracy. A simpler, portable valve tester operates from a wide range of a.c. supplies and is designed to meet Services requirements. Multi-range test sets included new instruments for resistance, a.c. and d.c., current and voltage, incorporating a new design of 20-way multibank switch, also available separately, with any number of banks; a much larger instrument has 95 ranges and covers frequencies up to 250 Mc/s with a radio frequency diode head. A valve voltmeter utilizing a coaxial diode rectifier probe of advanced type has a frequency response which is level from 20 c/s to 700 Mc/s, and ranges of 0 to 1,000 V d.c., 0 to 300 V a.c. and 0·2 MΩ to 500 MΩ. Another valve voltmeter incorporates a balanced four-valve d.c. amplifier employing almost 100 per cent negative feedback: this practically eliminates the effect of valve ageing and mains variation. The frequency range is 25 c/s to 150 Mc/s, and with the use of multipliers, voltages up to 15 kV can be measured.

Megohmmeters and insulation testers included a mains-operated instrument which measures resistances up to 2×10^{11} Ω at 10 kV and includes short-circuiting of the circuit under test when the power is switched off. An instrument for measuring the breakdown strength of liquid insulators overcomes the difficulty that the sample is normally contaminated by breakdown products after one test has been made. In this instrument, within a few microseconds of the initiation of breakdown, the specimen is short-circuited by a double spark gap. The voltage (up to 80 kV) is directly measured by a meter in the secondary of the test transformer.

A display of interest to the lighting engineer included a unit for initiating an arc in a high-pressure gas or metal vapour arc lamp, and demonstrations of radio interference from various types of lamp. Various types of relays shown on different stands included very small hermetically-sealed balanced armature types, and a miniature relay based on the moving-coil principle which will close contact with an energizing power of only 10 μW. A pneumatic time-delay relay has a delay variable between $\frac{1}{2}$ sec and 180 sec by a single screw adjustment on a solenoid-operated spring-loaded bellows. Maximum switching capacity is 250 V, a.c., 5 A.

A university department stand gave a glimpse into the possible future with three interesting electrostatic devices. One of these was a corona triode valve, consisting of a needle and a blunt electrode, with a third ring electrode around the needle tip. This arrangement shows all the properties of a triode, except that working voltages and valve constants are markedly different: $g_m=25$ μA/kV; $r_a=200$ MΩ; $\mu=5$. The remaining devices were loudspeakers: one operates by means of corona wind, and consists of an array of needles and screening rings; the other consists of a light, conducting diaphragm which aligns itself in an equipotential between two parallel open mesh electrodes with a high voltage between them. If an audio frequency voltage is applied to the diaphragm audible sound is produced, and the response appears to be smooth throughout the entire audible range.

Four-beam oscilloscope



Electric Locomotive Adhesion

OPENING the discussion on " The Adhesion of Electric Locomotives," the subject of a paper presented by Dr. H. I. Andrews before the Institution of Electrical Engineers on 28th April (*Electrical Review,* 29th April) Mr. C. C. Inglis (British Transport Commission) reported that the Commission had now set up an adhesion committee to co-ordinate the work already going on so that the whole problem of adhesion in relation to tractive effort and braking could be surveyed. The most striking feature brought out by the paper was variability. In the laboratory one might get 0·5 under controlled conditions, but in the field the variation could be 4 to 1, which was a significant pointer to the way to tackle the problem.

Mr. A. G. Hopking (British Transport Commission) pointed out that conditions to-day were more onerous than when the locomotives under consideration were built. Many observers appeared to have taken adhesion as the quality of the axle or locomotive to slip or not and had lost sight of two components at least that made it up —the true adhesion coefficient and the variation of the load on the axle. The paper might have made clearer that it was not the adhesion coefficient that was so low but the effect of the track and notching on the load on the axle.

Mr. J. L. Koffman (Ministry of Supply) said the paper showed coefficients of adhesion in excess of any previously given, except perhaps by Curtius and Kniffler. Regarding the use of liquid to increase adhesion, he wondered whether it had corrosive effects and how effective it was in snow or on sleet. In sanding tests carried out in Germany, an extension from the rubber hose was brought on to the rails so that the sand did not escape before the wheels reached it. His own interpretation of the results would be that the tractive effort should be applied in line with the centre line of the axles.

Further Tests Proposed

Mr. J. A. Broughall (British Railways) thought the paper constituted one of the most complete records ever placed before the Institution, with the accent rightly focused on the difficult cases. The tests would shortly be repeated with changes in the springs, sand, and so on. He felt that there was another quantity still undiscovered which might affect everything equally.

Mr. A. S. Robertson (English Electric Co., Ltd.) pointed out that in general little information was available on locomotive running resistance, probably because it was difficult to measure. The author's results were based on deducing the running resistance by taking the difference between the wheel tractive effort and the drawbar pull with an allowance for grade resistance. There might be some difference in the running resistance between a locomotive running off load with free running gear and one on load with all the running gear stressed.

Mr. D. E. Dodridge (British Railways) offered a possible explanation for the variation of adhesion along the track. He asked whether Dr. Andrews had examined the coefficients of adhesion using the true axle load as indicated by measuring the load on the spring hangers. Traction engineers required a curve showing the true adhesion, to which was applied factors covering weight transfer, whether the motors were connected in series or parallel, whether there was resistance or voltage starting for notching, peaks and so on.

Mr. D. T. Catling suggested that the products of braking from the braking material could further influence adhesion by forming a coating on the tyre. In stretches where heavy braking took place that might in time build up a deposit on the rail.

Mr. F. C. E. Smith asked whether the time factor entered into the coefficient of friction and the amount of water on the rail. After it had been raining for some time was there any improvement in adhesion? He referred to tests carried out by Allen in Erie, Pennsylvania, which showed that oil deposits on a rail could produce slippery conditions when small quantities of moisture were present —when dew was being deposited on the rail, for instance.

Mr. R. Ledger thought the ultimate question was what weight of train any actual locomotive would haul. He suggested that these tests might well be extended to other types of locomotive, particularly as adhesion depended to a large extent on rating. It was of little use designers putting in higher and higher continuous ratings which could not possibly be used in service.

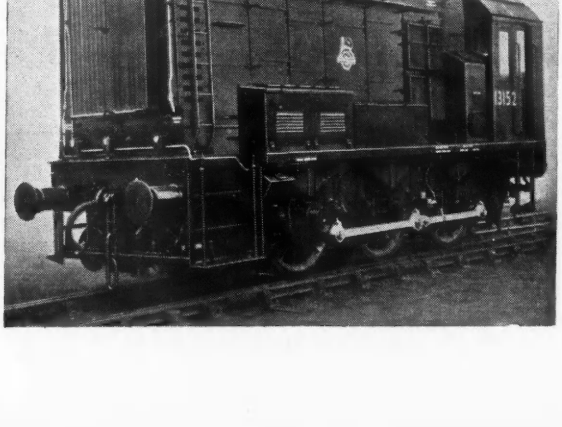
Shunting Locomotives for British Railways

THE first of fifteen standard 350 h.p. diesel-electric shunting locomotives with power equipment by the British Thomson-Houston Co., of Rugby, has now gone into service at the British Railways shunting yards, Immingham. The mechanical parts for these locomotives are being made at the British Railways locomotive works at Darlington, and closely follow the standard mechanical design and outward appearance which has been adopted for this class of locomotive.

The diesel engine being supplied with the B.T.H. equipment is the Lister-Blackstone type ERT6 rated 350 h.p. at 750 r.p.m. The B.T.H. traction generator is a single-bearing machine which is direct-coupled and spigot mounted on to the diesel engine, the complete set being supported on the locomotive frame at three points—one on each side of the generator and one at the forward end of the engine. A belt-driven exciter and an auxiliary generator are mounted on top of the main generator with a centrifugal blower for the traction motors overhung from the exciter. In the cab, the control equipment consists of a single control desk with duplicate running controls enabling the locomotive to be driven from either side of the cab.

A coupled 0-6-0 wheel arrangement has been adopted for these locomotives with the two outer axles driven through double-reduction spur gears by forced-ventilated traction motors. Each motor is arranged for spigot mounting on to its gearbox, thereby providing excellent accessibility.

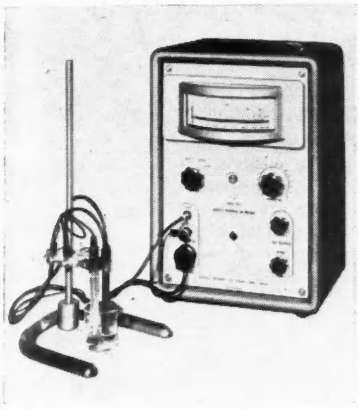
350 h.p. diesel-electric locomotive for British Railways



NEW ELECTRICAL EQUIPMENT

pH Meter

A new direct reading pH meter, model 23A, has recently been announced by ELECTRONIC INSTRUMENTS, LTD., of Richmond, Surrey,



Direct reading pH meter

and is a development of the model 23 pH meter, originally introduced in 1947. The direct reading pH meter has the important advantage that it can be used by unskilled operators as, once the instrument is standardized, it is only necessary to dip the electrode system into the solution being measured and to note the pH reading on the scale. In the same way, changes in pH may be continuously recorded without manual intervention by the operator.

The new model 23A has two important improvements. Automatic temperature compensation has been perfected, making the pH readings independent of changes in temperature of the solution being measured; this makes it no longer necessary to standardize the electrodes at the working temperature, and apply corrections to the pH readings if the temperature limits are exceeded. The second improvement is the provision of a higher output current (100 μA per pH unit) for operating recording or control instruments, and there is a new electro-pneumatic converter for direct connection to air-operated instruments.

The model 23A meter will maintain a zero stability of 0·02 pH almost indefinitely, despite any normal variations in mains voltage or frequency. In order to take full advantage of the exceptional stability and accuracy of the instrument, a 6in hand calibrated mirror-scale meter is provided, which enables readings to be made to 0·05 pH. The full range of the company's pH electrodes may be used with the model 23A, including special electrode systems for micro analysis and for continuous sampling under anaerobic conditions. In addition the instrument has been restyled and is finished in an attractive shade of chemically resistant enamel.

Transformer Radiator Valve

A new design of transformer valve has been developed by JOHNSON & PHILLIPS, LTD., Charlton, London, S.E.7.

Designed to offer a minimum of resistance to the flow of cooling oil and, at the same time, provide an easily accessible means of cutting off the oil as necessary, the valve embodies a new method of ensuring oil-tightness within the valve body. It is of compact design and can be readily attached to the transformer tank and the cooling radiators. It consists of a flanged housing, bored to form an oil

J. & P. transformer radiator valve

way, through which is inserted an operating spindle carrying a moving vane or butterfly.

The oil way is machined in such a manner as to permit the vane to seat satisfactorily in the bore and to provide a suitable degree of oil-tightness. The efficacy of the valve depends upon precise machining of the vane and the slot through the spindle to which the vane is attached, together with the method of boring the oil way. The body of the valve is drilled for attachment to the transformer tank, and common bolts secure the valve, gaskets and radiator flange to the tank wall. An open and shut indicator is fitted as standard and locking facilities can be provided.

Lighting Fittings

A new range of solid brass lighting fixtures, in the contemporary style, is now in production by PHILAMENT ELECTRIC, LTD., Kent Road, Trading Estate, Bridgend, Glam. The fitting illustrated is suitable for six 60 W b.c. lamps and its overall length is 30in. Available in satin brass, polished brass, polished gold and antique brass, it retails at £6 18s 7d, plus £1 3s 1d purchase tax in the United Kingdom.

Valve Voltmeter

Chief features of the new type GM6017 l.f. valve voltmeter recently introduced by PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2, are its excellent frequency range of 2 c/s to 200 c/s and its high sensitivity. Designed for the acoustic and ultrasonic frequencies, this instrument can be used to measure a.c. voltages in the investigation of electro-acoustical and electro-mechanical phenomena.

There are ten measuring ranges covering from 0 to 10 mV up to 0-300 V. An extremely accurate r.c. generator supplies fully-stabilized calibrating voltages of 10 mV, 100 mV, and 1 V at 400 c/s, which can also be used for other purposes such as bridge-feed circuits, impedance measurement, etc.

Output voltage to the moving-coil meter is obtained from a germanium diode bridge rectifier. By replacing this with an internal resistor, the GM6017 can be used as a wide-band amplifier with a gain of 1,000×. Other features are automatic protection against over-loading; a separate capacitor which can be shunted across the meter circuit to prevent needle vibration at low frequencies; and a linear anti-parallax scale.

Wall Fire

The Domestic Appliance Department of FERRANTI, LTD., Moston, has just placed on the market a new wall fire suitable for use in bathrooms, nurseries, sanatoria and consulting rooms, etc. A novel feature is an adjusting rod which is fitted to the

Ferranti wall fire

One of a new range of Philament lighting fittings

South Wales Switchgear "T" type gear

fire. This controls the movement of the reflector, thus enabling the user to direct the radiant heat beam as desired. The operation of the adjusting rod is a simple left to right screw action. The rod can be removed when not required.

Two models, W.5148 with a 750/1,000 W loading and W.5150 with 1,000/1,250 W loading, are available and full details and finish and dimensions, etc., are given in the makers' list FS.10.

Television Aerials

AERIALITE, LTD., Stalybridge, Cheshire, are now making "Aerdaptors" designed to be added to existing Band I dipole aerials to make them suitable in addition for use on Band III, no alteration to the existing aerial being necessary. Various arrangements of elements are available as well as a variety of fixings. Complete aerials for use on Band III are also being made, some designed for wall or chimney mounting, others for mounting on a drainpipe or mast which can form the reflector element. Another item is the Aerialite converter to operate with an existing receiver having no facilities for Band III tuning, and priced at £9 10s.

Switch-fuse Gear

A range of switch-fuse gear for 660 V service up to 800 A has recently been introduced by SOUTH WALES SWITCHGEAR, LTD., Blackwood, Monmouthshire. This is known as the "T" type. The units are of the movable link pattern so that both terminals of the fuse are isolated when the switch is opened. The moving contact stems are suitable for fitting standard h.r.c. fuse cartridges and the three-phase fuses are mounted on a common carriage completely removable from the unit.

The door-mounted mechanism is of the positive close, spring controlled, quick-break, trip-free handle pattern and is arranged to lock "over toggle" when closed, thus eliminating any outward movement under short circuit conditions. In order to maintain the flush fronted appearance, the operating handle is removable.

The standard cubicles are 5ft high and permit the use of three tiers of switches, but four or five tiers can be provided using higher cubicles, if required. Busbars up to a maximum capacity of 1,200 A vertically and 2,000 A horizontally can be fitted as standard and larger sizes if specially required. Rear access cabling is the normal arrangement.

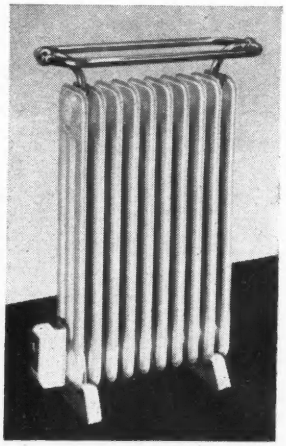
Twist Drills

A "Dormer" drill set containing the correct tapping drill sizes for the range 0-12 BA has just been placed on the market by the SHEFFIELD TWIST DRILL & STEEL CO., LTD., Summerfield Street, Sheffield, 11.

The drills, which are particularly suitable for an electrical operative's kit, are in a diaphragm type plastic base which ensures their being securely held but easily removable. The centre of the base is clearly marked with the tap size for immediate identification, and further information is printed on the aluminium cover case.

Radiator Towel Rail

A new highly polished chrome towel and airing rail attachment to their oil-filled electric safety column radiator is now available from HURSEAL, LTD., 229, Regent Street, London, W.1. The towel rail attachment bolts on to the radiator, overhanging it at each end and at the sides. The polished chrome provides a smooth surface which will not catch or damage clothes.



Hurseal radiator fitted with airing rail

The airing rail is made in two sizes. For the 1 kW column radiator it is 20in long and costs £3 19s 6d plus 14s 6d purchase tax in this country. For the 2 kW column radiator it is 30in long and costs £4 11s 6d plus 16s 8d purchase tax.

Cable Eccentricity Gauge

An improved cable eccentricity gauge has been added to their range of eccentricity and size control equipments for extruded wires and cables by the ADDISON ELECTRIC CO., LTD., Bosworth Road, London, W.10.

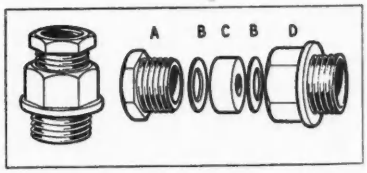
This new model is based on a capacitive method in which two self-aligning electrode arms touch the cable under test, and eccentricity is indicated by a moving coil meter. The latter is calibrated directly in percentage eccentricity.. The meter has full scale deflections of ± 25 per cent with a centre zero, allowing a readability to about 0·5 per cent eccentricity, referred to the wall thickness of the dielectric.

As opposed to the earlier model 155, which operates on an inductive principle, there is no need for the injection of a pilot current into the cable under test; the latter has, however, to be dry while being measured. Two units may, if required, be employed with their electrode arms at right angles; extension meters and recording facilities are available, similar to those used with Addison size controllers.

Weatherproof Cable Glands

A new range of weatherproof cable glands moulded in black "Grillon," a shock-resisting plastic material, has been introduced by ELKAY ELECTRICAL MANUFACTURING CO., LTD., 42, Woburn Place, London, W.C.1. Designed for rough usage, they are suitable for screwing into switch and conduit boxes, fuse boxes, etc., or wherever a weatherproof cable entry is required, and also as a strain relief bushing to prevent dragging or chafing.

The gland consists of five parts, the body portion, rubber gland, two metal washers and clamping bush. Four sizes are available, ranging from ½in to ¾in cable entry sizes.



The "Elkay" weatherproof cable gland consists of five parts: clamping bush (A), two metal washers (B), rubber gland (C) and body portion (D)

VIEWS on the NEWS

By REFLECTOR

WHILE there are strong influences at work in this country endeavouring to get rid of trolley-buses many cities in the United States and Canada are continuing and strengthening their trolley-bus services. According to *Public Transport*, a bulletin issued by the British Electrical and Allied Manufacturers' Association, there are now 8,500 of these vehicles in North America operating from 58 centres which include such important cities as Dallas, Detroit, Los Angeles, Ottawa, Regina, Toronto and Vancouver. What is perhaps strange among people who are so ready to replace equipment, even before it is worn out, is that a large majority of the trolley-buses have been in service for at least fifteen years—some for as much as twenty-two years. For various reasons, among them low energy costs and maintenance, trolley-buses are able to earn a profit when oil-engined buses owned by the same undertakings show a loss. As in this country, passengers (whose preferences seem to be given more attention in North America) are thoroughly in favour of the trolley-bus because of its comfortable riding, cleanliness, and smoothness of control.

* * *

Protests from people in districts remote from the public supply at the high cost of extensions to their premises are very common nowadays but probably none of them have been asked for as much as £8,572. This was said, at a meeting of the Airdrie, Coatbridge and District Water Board, to be the cost of installing electric light at the waterman's house at Cowgill Reservoir, and one member justly described it as "somewhat staggering." The water engineer suggested, as an alternative, the provision of a water-driven turbine and generator costing £1,000 or a diesel-electric generator for £650. A member of the Board thought that wind-power was the solution but the Board, quite understandably, decided to defer its decision.

* * *

When overhead lines really mar scenic beauty there is strong justification for their replacement by underground cables, even at some expense, but I doubt whether the case is so strong when they are believed merely to interfere with entertainment. At a recent meeting of the March (Cambridgeshire) and District Trades Council a member said that there had been quite a lot of complaints about interference with television from overhead lines and he wondered whether it would be possible to "suppress" the lines or put them underground. Although doubts were expressed about the lines being the cause of interference it was agreed to send a letter of complaint to the Eastern Electricity Board.

* * *

Two recent prosecutions for the fraudulent consumption of electricity again brought to the public notice the activities of the Fixed Price Light Co. which is by no means moribund. It is strange that in this age of high wages many people are still content to pay a weekly charge for a limited supply when the full benefits of electricity are available to all. Be that as it may, these cases concerned the same premises the tenants of which were entitled to a supply for a 100 W lamp, a radio set and an iron. The fraudulence consisted of the installation of a 750 W fire, tapped off the radio set plug, and it was stated that the fuses were strengthened from 2 A to 180 A. "Strengthened" seems to be a mild term to apply to such reinforcement.

* * *

As I expected, there were special circumstances attaching to the case of the consumer whose letter to the *Evening News* (Glasgow) relating to the purchase of an electric cooker I recently quoted. Without going into the details, which are somewhat involved, I am glad to say that a consumer in the South of Scotland Electricity Board's area can, in fact, order or purchase electrical apparatus at any one of the Board's many service centres for delivery from the centre in the district in which he lives. As an indication of the energy with which the development of the electric cooking load is being pursued in the South of Scotland, I have been given the following figures of cookers supplied during the last six years:—1949-50, 4,920; 1950-51, 7,897; 1951-52, 8,126; 1952-53, 8,662; 1953-54, 15,318; and 1954-55, 27,646. Such excellent results speak for themselves.

* * *

When I was told last week by a friend that he was attending the *Mechanical Handling* golf meeting I thought what a delightful idea this was and how much labour which ordinary golfers undertake would be eliminated at such a gathering. I visualized the clubs following the golfer round on a little battery truck with a fork-lift attachment for getting the ball over bunkers, a small belt conveyor to deposit the ball accurately in the hole at each green and other refinements to increase the player's efficiency and productivity. Alas! I am informed that the rules of the game are too rigid to permit of such extraneous aids.

* * *

Fifty years ago there appeared an article in the *Electrical Review* (5th May, 1905) on "Electricity as Motive Power for an 1,100-ton Cargo Boat." The author, J. W. H. Hamilton, referred to previous electric ship propulsion systems but in these either batteries or (for canal barges) small locomotives fed from trolley wires were employed. He believed the idea of carrying a complete generating plant and using electric motors on the propeller shafts was probably new. The ship described was the *Vandal*, built in Nijni Novgorod, Russia, for oil transportation. She had a length of 245ft and a beam of 32ft. Power was derived from three 120 h.p. Swedish diesel generating sets each feeding its own propeller motor but cross connected to enable it to be used for either of the other motors. The steering equipment was also electrical and details were given in the article on the control system. Mention was made of a second ship in course of construction in which the motive power was provided by two 180 h.p. diesel generators.

PARLIAMENTARY REPORT

Technological Education

In a debate on education in the House of Commons last week, the Minister, Sir David Eccles, said that he had agreed to the payment of special allowances for all teachers of advanced work in schools and this would help to secure for the teaching profession a better share of science and mathematics graduates. It was not a matter of money alone, and he was glad to say that he had the co-operation of other Government departments and industry so that he hoped to recruit at least the minimum number of graduates required. Allowances to university students would be increased.

In the United States three times the proportion of pupils went to universities than was the case here. In that way they obtained a much larger number of technically-skilled people than we did, but it would alter the whole character of our universities and grammar schools if we tried to treble them. It was better to try to build, alongside the grammar school-university stream, many strong and various streams leading from the secondary modern schools to the technical colleges, technological institutes and all other forms of higher education.

It was difficult and seldom desirable to concentrate too much vocational education in secondary modern schools in one place but where there was so much engineering in a particular district that it was necessary to have an engineering secondary school, he would agree to it.

Sir Hugh Linstead suspected, however, that many of the misunderstandings about the way to produce more technologists was due to a confusion in nomenclature. The technologist, as required by industry to-day, was the man who understood and employed in his work the fundamental scientific theories and knowledge that underlay the particular technology in which he was engaged. He was the man to do the basic research upon which development depended and who could tackle new problems. At the moment the educational system was not making the necessary provision for him. The technician, on the other hand, was the highly-skilled man who applied existing techniques; who might be responsible for minor developments but did not usually invent new ones. At the moment he was adequately provided for by the technical colleges.

The Government's new policy included a massive development of the Imperial College of Science and Technology in South Kensington, substantial extra grants to universities and a few selected major colleges of technology, and the development of about 30 technical colleges. This was encouraging but the last-mentioned development implied some confusion between the technician and the technologist and a misunderstanding of the real needs of industry. The person whom industrialists found to be scarce was the scientifically trained man who, at 18-plus had taken at least a three-year full-time course or its equivalent in part-time education. By and large, they needed the man with the university degree or its equivalent. Had the Government decided on the development of fewer technical colleges they could have raised a certain number of colleges to the level which was now needed to turn out the technological expert, but by spreading the available research over 30 colleges the danger was that none would be raised to the necessary level.

Sir Hugh said that he felt that the National Advisory Council on Education for Industry and Commerce had themselves been confused about its objective. One of their proposals was a new national award in technology in certain technical subjects to be granted to students who had attended approved courses in technical colleges —not in approved technical colleges. By developing courses in these colleges the system was likely to produce the man who was expert up to a certain level in his own technique but lacking the very thing that industry said it wanted: the man with the all-round educational background and the broad scientific experience. He did not see that a new national award was needed for the full-time man who had diplomas and degrees galore available to him.

If it was to be primarily for the part-timer, the man who came up the hard way, it would be rather letting him down because he would be presented with a bit of paper which would not be acceptable to would-be employers who would want to look behind it and discover whether the man had had a broad general education or only a highly specialized one.

Mr. Frederick Peart pointed out that the Select Committee on Estimates on Technical Education in 1953 reckoned that an estimated investment of £75 million was needed if the country was to be able to claim it had the minimum facilities for technical education, but the country was then spending only £1½ million on building work. Much more money should be devoted to extending the technological colleges.

Sir David Eccles replied that the provision for buildings for technical education this year was up from £4½ million to £7½ million, but he would like to do better still.

Replying to the debate, Mr. Dennis Vosper, Parliamentary Secretary, Ministry of Education, said that there were 10,900 graduate teachers of science and mathematics in the schools to-day; 14,100 would be required by 1960. At the present rate of increase that was not likely to occur and the Minister hoped to take further action to accelerate the increase.

Railway Electrification

Mr. Leslie Hale asked the Minister of Transport and Civil Aviation what priority was allocated to the railway from Manchester to Oldham and from Oldham to West Yorkshire in the scheme of railway electrification recently announced by him.

Mr. Boyd-Carpenter said he was not in a position to make a statement about the priority to be attached to particular proposals. The British Transport Commission would produce annual forecasts of work to be undertaken and the first of these would be published soon.

Single-Wire H.V. Distribution

Mr. Vane asked the Minister of Fuel and Power whether his attention had been drawn to the use of single wire high-voltage distribution adopted both in New Zealand and Australia as a means of reducing the cost of providing a supply of electricity in thinly populated rural areas; and whether he would give a general direction to the Central Electricity Authority to carry out experiments on an appropriate scale this year.

Mr. Joynson-Hicks, Parliamentary Secretary, Ministry of Fuel and Power, replied that the single wire system had not so far been adopted in this country because of the possibility of greater danger to the public and of interference with communications, but there might be places where it could be properly used. He was informed that the Southern Electricity Board had undertaken an experimental scheme, which was brought into use on 25th April, and a number of other experiments were proposed.

North Wales Hydro-Electric Bill

The Special Report of the Select Committee of the House of Lords on the North Wales Hydro-Electric Power Bill promoted by the Central Electricity Authority says that the Committee is satisfied that a good case has been made out for the Bill and that the effect of the schemes sanctioned by it on the hill pasture and agricultural land will be as small as possible. The effect was wholly reasonable considering the nature of the proposals.

The Bill gives power to the C.E.A. to construct two hydro-electric stations, one at Blaenau Festiniog and the other in the Rheidol Valley. The total area permanently lost to agriculture on the completion of the scheme would not exceed 800 acres, of which about 750 acres are fit for hill pasture only.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Minister of Fuel and Power has appointed **Mr. W. Gilbert,** M.I.E.E., of Ipswich, to be deputy chairman of the Eastern Electricity Consultative Council in place of the late Mr. R. O. C. Hurst.

The South Wales Electricity Board announces that **Mr. H. B. Holloway,** B.Sc., A.M.I.E.E., formerly district commercial manager, District 346 (Porth), has been appointed to take charge of the industrial supply section in the Commercial Department in the Central Sub-Area at Cardiff. He succeeds **Mr. H. Jackson,** B.Sc., M.I.Mech.E., M.I.E.E., who has recently been appointed head of the industrial supply section in the Commercial Department at the Board's head office at St. Mellons.

Mr. C. D. H. Webb, executive director of the Plessey Co., Ltd., has been appointed a director of Plessey International, Ltd.

Mr. E. A. Fowler, M.I.E.E., F.I.E.S., tells us that he is relinquishing his present appointment as chief commercial officer to the Eastern Electricity Board. He will shortly join the headquarters staff of the General Electric Co., Ltd., at Magnet House, Kingsway, London. Mr. Fowler has held his present position since 1949 and, before that, was for many years with the Yorkshire Electric Power group.

Mr. E. A. Fowler

The South of Scotland Electricity Board has appointed **Mr. Henry Walton,** A.M.I.E.E., as engineer, Fife Area. After apprenticeship and early experience with Todmorden Corporation Electricity Department, Mr. Walton was mains assistant with Whitehaven Corporation and Carlisle Corporation Electricity Departments. In 1942 he joined the Air Ministry Works Directorate and in 1945 returned to Carlisle Corporation as district mains engineer. Mr. Walton was appointed mains superintendent at Kirkcaldy in 1947 and in 1948 he became construction engineer (substations) and subsequently senior assistant engineer (technical) in the Fife Sub-Area of the South East Scotland Electricity Board.

Mr. H. A. Keeling has been appointed to the main board of Newey & Eyre, Ltd., Dudley, Worcs.

The B.T.H. Co. announces the appointment of **Mr. A. B. Frost** as manager of its Northampton lamp depot. He succeeds **Mr. F. E. Perry,** who has left the company to take up an appointment with the E.M.F., Ltd., Northampton.

Gresham Transformers, Ltd., recently transferred the production of small transformers for the electronics division to its Lion Works on Hanworth Trading Estate, Feltham. **Mr. K. G. Lockyer,** B.Sc., A.M.I.E.E., A.M. Brit. I.R.E., who has been appointed manager of the Lion Works was formerly production manager with Solartron Laboratory Instruments, having previously been with Philips (Mitcham Works), Ltd., the Plessey Co. and the London Electrical Co., Ltd.

Mr .K. G. Lockyer

Mr. J. N. MacDonald, B.A., A.M.I.E.(India), executive director, B.T.H. Export Co., retired at the end of April and **Mr. H. E. Wethered** has been elected to the board to fill the vacancy.

Mr. MacDonald, an Australian by birth, was educated in England, at Cheltenham College and Cambridge, taking the B.A. (mechanical science) degree in 1911. After serving a student apprenticeship at Siemens Bros. Works, Stafford, he joined the staff of the B.T.H. Co. in 1913; but during the 1914-18 war served in France and Italy, being mentioned in despatches. On demobilization as a major he returned to the B.T.H. Co. on the staff of the Export Department and in 1920 was posted to the Calcutta office. In 1922, after a duty tour in the United States, he returned to India and was appointed manager at Bombay. In 1929 he returned to England to take an appointment in the London Section of the Export Department, and in 1944 was appointed export manager. Mr. MacDonald joined the board of the B.T.H. Export Co. in 1949 as executive director.

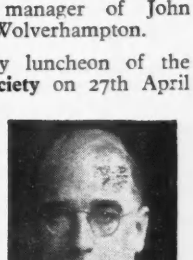
Mr. J. N. MacDonald

Mr. H. E Wethered

Mr. Wethered was educated and trained for H.M. Navy, leaving the R.N. College, Dartmouth, for active service afloat in 1917. He was invalided from the R.N. in 1923 and enrolled as a student at Faraday House, gaining a 1st class certificate and diploma in 1925, followed by a practical course in the B.T.H. Rugby Works. Mr. Wethered joined the staff of the B.T.H. Export Department in 1927. He rejoined the Export Co. in 1934 but on the outbreak of war in 1939 was recalled to the Navy, serving both overseas and at home in shore appointments. Comdr. Wethered rejoined the B.T.H. export staff on demobilization towards the end of 1945, and in 1949 was appointed manager, eastern sales, B.T.H. Export Co., London.

Mr. L. Edgar has been appointed group publicity manager of John Thompson, Ltd., Wolverhampton.

At the monthly luncheon of the **Batti-Wallahs' Society** on 27th April Mr. C. N. Good, the retiring president, invested his successor, Mr. G. O. Watson, with the badge of office. The speaker at the luncheon was Dr. G. E. Foxwell, a past-president of the Institute of Fuel and a member of the Beaver Committee on Air Pollution, who gave a masterly summary of the main features of the report with special reference to one or two electrical aspects. A vote of thanks was accorded to Dr. Foxwell on the motion of Mr. P. V. Hunter, a past-president. Mr. T. C. F. Bigland (the "Mate") announced that the next luncheon would take place on 26th May when the speaker would be Air Marshal Sir Victor Goddard.



Mr. G. O. Watson

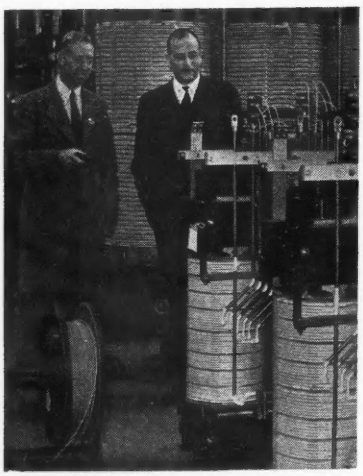
The Institute of Welding and the British Welding Research Association held a luncheon at the Hyde Park Hotel on 25th April to celebrate the eightieth birthday of **Sir William J. Larke,** K.B.E. Sir Claude Gibb, C.B.E., F.R.S., was in the chair, supported by the president of the Institute, Mr. R. G. Braithwaite, and the chairman of the Council of the British Welding Research Association, Sir Charles Lillicrap, K.C.B., M.B.E.

Mr. Braithwaite presented to Sir William the certificate of his honorary Fellowship of the Institute of Welding and Sir Charles Lillicrap presented an illuminated address on behalf of the Institute and the British Welding Research Association. The toast of Sir William Larke's health was proposed by Sir Claude Gibb, the chairman.

Mr. E. H. Skinner, M.I.E.E., has been appointed chief commercial officer of the South Eastern Electricity Board in succession to **Mr. C. F. Wells,** who retired on 28th February. He previously held the position of deputy engineer-in-chief and before that had been Central Sussex deputy manager and Brighton and Hove manager since joining "Seeboard" in 1948. Born in London fifty-five years ago, Mr. Skinner studied at Regent Street, London, Polytechnic, and began his thirty-two years in the electricity supply industry with Stepney Borough Council in 1923. He was with Colchester Borough Council from 1933 in 1944, first as installation and meter superintendent and later as deputy borough electrical engineer. In 1944 Mr. Skinner was appointed city electrical engineer and manager at Chichester and on nationalization of the industry had a short period as Portsmouth district executive officer for the Southern Electricity Board before joining Seeboard. He is president of the Brighton, Hove and Worthing branch of NALGO.

Mr. E. H. Skinner

Mr. J. E. Mitchell, city electrical engineer, Salisbury, Southern Rhodesia, is at present on a visit to this country during which he is visiting a number of works. Recently he went to the works of Transformers (Watford), Ltd., and in the accompanying picture he is seen with Mr. G. E. Proctor, managing director, inspecting station and unit auxiliary transformers for the City of Salisbury No. 3 power station.



Mr. J. E. Mitchell (left), city electrical engineer, Salisbury, Southern Rhodesia, at the works of Transformers (Watford), Ltd. With him is Mr. G. E. Proctor, managing director

Mr. A. McLean, who joined the board of C. A. Parsons & Co., Ltd., on his retirement from Barclays Bank five years ago, has now retired from all activities. **Dr. A. T. Bowden,** for the past ten years chief research engineer of the company, has been appointed a director.

Consequent upon the inauguration of the Metropolitan-Vickers X-Ray Department, which took over the business of M-V's subsidiary, Newton Victor, Ltd., at the beginning of the year, the branch offices of Newton Victor were amalgamated with the district offices of Metropolitan-Vickers. **Mr. H. B. Gough,** Associate I.E.E., was appointed sales manager, X-Ray Department, and **Messrs. G. E. H. Deadman,** B.Sc. (Birmingham), **R. B. Gough** (London), **A. R. Holdsworth** (Sheffield), **D. Moodie** (Glasgow), **H. A. Ryder** (Cardiff) and **J. Taylor** (Manchester) were appointed superintendents, Newton Victor sales, in the districts stated. **Mr. F. W. Waterton,** M.I.E.E., had previously been appointed assistant chief engineer, X-Ray Department (Finchley Works). Mr. A. K. Nuttall remains chief engineer, X-Ray Department, and Mr. J. T. Thornhill works manager (Motherwell and Finchley Works).

Mr. H. B. Gough

Mr. F. W. Waterton

Mr. Gough received his technical education at the Northampton Polytechnic, and in 1922 he joined Watson & Sons (Electro-Medical), Ltd., of which he subsequently became chief engineer. In 1930 he transferred to the Victor X-Ray Corporation, Ltd. (a branch of the General Electric X-Ray Corporation of U.S.A.), as manager of the Manchester Office, and in 1935 he became sales manager. After war service he was appointed director and sales manager of the Victor X-Ray Corporation, and on its amalgamation with Newton & Wright, Ltd., to form Newton Victor, Ltd., he was confirmed in these posts. He is a member of the British Institute of Radiology and of the Society of X-Ray Technology.

Mr. Waterton joined Metropolitan-Vickers as a school apprentice in 1928 and for many years he has been engaged on design and development of high voltage measuring instruments and X-ray tubes.

Mr. G. B. Russell has been appointed manager of the Contracts Department of Enfield Cables, Ltd., responsible to the sales director. Mr. Russell has for the past four years been in charge of the company's operations in Canada. He will take up his duties towards the end of May.

The annual general meeting of the Sussex Centre of the **Electrical Industries Benevolent Association** will be held on 17th May (5.30 p.m.), at the offices of the South Eastern Electricity Board, Castle Square, Brighton.

The Secretary of State for Scotland has appointed **Mr. George Baxter,** O.B.E., M.I.C.E., M.I.W.E., city water engineer, Edinburgh, to be a member of the Fisheries Committee in place of Mr. William Gray, M.B.E., M.I.Mun.E., M.I.W.E., a former water engineer of Ayr County Council, who has resigned on health grounds.

The North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board are required to avoid as far as possible injury to fisheries and the stock of fish in any waters affected by their works. The Fisheries Committee was first appointed in September, 1943, to give advice to the North of Scotland Board and the Secretary of State on these matters and its advice will now be available to both Boards.

Mr. H. H. Begent

Mr. H. H. Begent, M.I.E.E., M.Am.I.E.E., has rejoined the English Electric Co., Ltd., as deputy sales manager of the Transformer Department, Stafford.

Mr. L. H. A. Carr, M.Sc.Tech., M.I.E.E., consulting engineer (patents) with the Metropolitan-Vickers Electrical Co., Ltd., retired at the end of April. Apart from his work with Metropolitan-Vickers he was a prominent figure in the activities of the Institution of Electrical Engineers, of which he has held the offices of hon. secretary, North Western Centre (1935-42), chairman of the Centre (1942-43), hon. treasurer of the Centre (1944-54) and ordinary member of Council (1945-48). Of his published papers, several have been awarded special premiums. His association with technical education includes part-time lecturing for twenty years at the Manchester College of Technology, membership of the Court of Governors of Manchester University and of committees of the City and Guilds of London Institute and the

Mathematical Association. Mr. Carr joined Metropolitan-Vickers in 1920, and held the position of consulting engineer (patents) from 1943. He proposes to undertake consulting work in a private capacity.

We have already reported that **Mr. R. H. Gummer** will succeed **Dr. W. Idris Jones** as president of the Institute of Fuel. **Mr. W. N. C. Clinch** and **Dr. W. A. Macfarlane** have become vice-presidents.

Mr. F. P. Bowden, Sc.D., F.R.S., of the University of Cambridge, has been appointed chief research consultant and in charge of the Tube Investments Research Laboratories, Hinxton Hall, Cambridge.

Mr. Frank J. Hawkins, A.M.I.E.E., recently retired after forty-five years' service with the British Thomson-Houston Co., Ltd. Mr. Hawkins is internationally known in the lamp manufacturing field. Last year he was a British delegate at the fiftieth anniversary meeting of the International Electrotechnical Commission held in Philadelphia, acting as chairman of one of the main committees. The Electric Lamp Manufacturers' Association entertained him at a luncheon on the occasion of his retirement. Having been in office since 1922, he holds the record for the longest serving member of the E.L.M.A. Committee. He has been a member of the Illuminating Engineering Society since 1910.

Mr. F. J. Hawkins

In the report on page 731 of last week's issue referring to the presentations at the **Institution of Electrical Engineers** on 21st April, the captions of two of the photographs were inadvertently transposed. The lower right-hand picture showed Sir John Cockcroft acknowledging the presentation of the Faraday Medal and that above it Dr. W. Shockley delivering the Kelvin Lecture.

OBITUARY

Mr. C. A. Lloyd. — William McGeoch & Co., Ltd., inform us of the death on 16th April of Mr. Cyril A. Lloyd after a few months' illness. Mr. Lloyd, who was in his seventy-third year, joined the company as an office boy at the age of fourteen and at the time of his retirement in 1953 had had fifty-eight years' service; he was then manager of the company's Ships' Electric Fittings Department.

Mr. W. E. Burnand.—The death occurred in Sheffield on 24th April, at the age of eighty, of Mr. William Ernest Burnand, M.I.E.E., founder and principal of W. E. Burnand & Son, electrical engineers, Sheffield. He was a past member of the Council of the Institution of Electrical Engineers, a past chairman of the North Midland Centre, and a past chairman and for 18 years hon. treasurer of the Sheffield Sub-Centre.

Mr. W. F. Bishop.—It is with regret that we have to record the death of Mr. W. F. Bishop, C.B.E., a director of W. T. Henley's Telegraph Works Co., Ltd., which occurred on 27th April, only five days short of his 76th birthday. Mr. Bishop joined Henley's in 1895. After experience in many departments at head office and works, he held successively the positions of chief of the Estimating Department, sales manager, and assistant general manager. In 1932 he became general manager of the company, and in the following year he was elected to the board. He relinquished his position as general manager in 1943, to free himself for special duties, whilst remaining a director of the parent company. His term of office as general manager included some of the most difficult years in the company's history, and, associated with the late Sir George Sutton, he contributed largely to the success which followed.

The late Mr. W. F. Bishop

On completion of fifty years of service with Henley's in 1945, Mr. Bishop received a presentation from the board in recognition of his long service, and also gifts from the staff in token of their esteem. He would have achieved the distinction of being the only member of Henley's to serve with the company for sixty years had he survived another three days, and he was to have received due recognition from the board to commemorate the occasion.

Mr. Bishop was recognized as a leader in the electrical industry, and served as chairman of the Cable Makers' Association, on the I.E.E. Wiring Regulations Committee and several other committees. He was president of the London Branch of the Association of Mining Electrical Engineers, and during the last war was chairman of the Cablemakers' Planning Committee. He was a Freeman of the City of London, and a Liveryman of the Worshipful Company of Gardeners.

In addition to his association with Henley's Mr. Bishop's many other activities included directorships of Connolly's (Blackley), Ltd., Metropolitan Cables, Ltd., United Telephone Cables, Ltd., and Southern United Telephone Cables, Ltd., of which company he was also chairman for the past twenty-three years, that is, since its foundation.

WILLS

Mr. J. Harwood Lumsden, formerly sub-area manager, North Western Electricity Board, who died on 11th November last, left £9,067 gross (£8,960 net).

Mr. C. L. E. Stewart, M.I.E.E., M.Cons.E., formerly borough electrical engineer and tramway manager at Rawtenstall, who died on 17th November last, left £17,020 gross (£16,935 net).

Mr. H. Foulds, F.C.I.S., secretary of the former Callender's Cable and Construction Co., Ltd., who died on 23rd December last, left £21,605 gross (£20,734 net).

Mr. J. E. Chamberlain, chairman and joint managing director of Switchgear and Cowans, Ltd., who died on 31st December last, left £14,160 gross (£11,499 net).

Mr. F. R. M. De Paula, C.B.E., F.C.A., late a director of the Brush Electrical Engineering Co., Ltd., who died on 13th December last, left £48,500 gross (£45,027 net).

Mr. J. W. Jackson, M.I.Mech.E., A.M.I.E.E., formerly of the North Eastern Electric Supply Co., who died on 19th October last, left £5,582 gross (£5,394 net).

Mr. D. A. Bremner, director of the British Engineers' Association, 1919-43, who died on 7th February last, left £3,542 gross (£3,025 net).

Mr. L. Wall, Birmingham sales manager for Electrical Components, Ltd., who died on 25th September last, left £4,409 gross (£4,149 net).

Mr. W. L. Gamble, chief electrical installation engineer of W. J. Furse & Co. (Manchester), Ltd., who died on 27th December last, left £4,420 gross (£4,312 net).

Mr. J. E. Macewan, A.M.I.E.E., consulting engineer, who died on 7th January last, left personal estate in England and Scotland valued at £39,898.

ALUMINIUM DEVELOPMENT

It is only just over 100 years since the first commercial process for the production of aluminium was evolved, and the present electrolytic methods now used throughout the world industry are little more than sixty years old. The British Aluminium Co., Ltd., was formed in 1894 and acquired the British rights in the Baver process for the extraction of alumina from bauxite, and the Heroult patents for reducing alumina to the ingot metal aluminium. It has now issued a booklet outlining its history. It opens with a brief outline of the early work by Sir Humphry Davy and others, through the Deville chemical process, to the discovery in the 1880's of the basic methods used to-day. Then follows the history of the company. The development of its subsidiaries, both in this country and abroad, are also referred to and the booklet concludes with a survey of welfare arrangements, and the management of the 150,000 acres of farm land and forest involved in the hydro-electric schemes. The publication is profusely illustrated.

East Yelland Power Station

In connection with the description of the East Yelland power station published in our last issue we are informed that the boiler feed pumps and condensers for this station were supplied by G. & J. Weir, Ltd.

Water Power in New Zealand

With the completion of Dunedin City's Waipori hydro-electric scheme, the South Island of New Zealand now has its replica on a small scale of the great chain of generating stations which are being built on the Waikato River, North Island. The water of the Waipori stream, augmented by the stored water in the artificial Lake Mahinerangi, is now tapped four times to provide Dunedin with electricity and to contribute in times of need to the South Island grid system.

Dunedin is the only large city in New Zealand with its own generating system and it was one of the first in the country to install power plant. Waipori was first developed on a modest scale by a private company, but after a lively controversy the city took over the scheme and has gradually developed it during the last half-century.

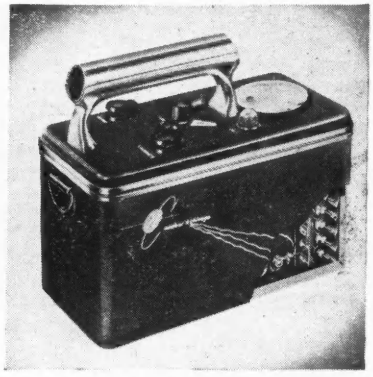
Before the last war Waipori consisted of two stations with a total capacity of 26,000 kW. The city's electricity requirements at peak periods had already outstripped these resources and power was brought from the State scheme on the Waitaki River to augment Waipori. Since the war, at the urgent request of the Government, the city has undertaken further development and at an official opening function on 1st April the fourth station on the river was linked with the South Island grid system. With the third and fourth stations (each of 7,000 kW) the capacity at Waipori is now 42,000 kW. This has been done without any additional use of stored water as the source of power is tapped repeatedly between the dam and the lowest station. The new stations are completely automatic and will be operated by remote control. Total expenditure on the scheme, which involved extensive tunnelling, was slightly over £1 million. On the basis of capacity this is high but the South Island needs are so urgent at present that it is considered a worthwhile project.

Prospecting Instrument

A new uranium prospecting instrument, the model 2613 "Oracle," has been introduced by the Nuclear Instrument & Chemical Corporation, Chicago. It enables a large area to be covered quickly, and the 0·1 per cent uranium sample supplied permits a good preliminary estimate of the importance of any find. The instrument is of rugged construction and is very sensitive in operation. A "cluster" of ten specially treated, long-life Geiger tubes is designed for highest sensitivity to the gamma rays emitted from uranium ores. Changes in radio-activity as small as 0·001 mr/hr can be read, thus making small variations in general radiation easy to detect. If one or more of the tubes should fail, it would be still possible to use the instrument because a control is provided for recalibrating the instrument to the uranium ore sample supplied.

Three overlapping ranges cover radiation intensities of 0·02, 0·2 and 2 milli-röntgens per hour full scale. Normal cosmic ray background fluctuation is less than five per cent and is approximately half scale on the most sensitive range. Because of the high sensitivity, the meter reading is extremely stable, making it possible to read small intensity differences caused by a uranium ore outcrop.

A special 900 V stabilized audio oscillator h.v. supply for the Geiger tube "cluster" provides a long continuous battery life equal to a shelf life when operated two hours per day. A



The "Oracle" uranium prospecting instrument

neon on-off light is mounted on the panel and gives a visual indication in case of battery failure. The circuit is designed to operate at any temperature from 0 deg F to 120 deg F. The instrument is dispatched with a detector pack, batteries, a 0·1 per cent uranium sample, a carrying strap, earphones, and a prospecting manual.

Derby Trolley-bus Extensions

At an inquiry held at Derby on 22nd April representatives of local authorities and private residents opposed Derby Corporation's application for sanction to extend the trolley-bus service on three routes. The inquiry took place before Sir Robert Tolerton, an inspector appointed by the Minister of Transport and Civil Aviation. Mr. F. A. Stockdale, appearing for Derby Corporation, said that the Corporation had originally applied to the Minister for a Provisional Order authorizing the use of trolley-vehicles along four short additional routes. In the case of one proposed route, involving a mile of Mansfield Road, in Breadsall, the Corporation had withdrawn its application, following negotiations with objectors. Later in the inquiry it was stated that Derby Corporation had reached agreement with the Trent Motor Traction Co., Ltd., to operate a joint motor-bus service on this route.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £163 0s 0d
COPPER, H.C. Electro	ton £304 10s 0d
Fire Refined 99·70%	ton £303 0s 0d
Fire Refined 99·50%	ton £302 0s 0d
COPPER Tubes ..	lb 2s 11¾d
Sheet	ton £376 5s 0d
H.C. wire and strip ..	ton £348 0s 0d
LEAD, English ..	ton £103 10s 0d
Foreign	ton £102 0s 0d
MERCURY	flask £108 0s 0d
TIN, block (English) ..	ton £709 10s 0d
ZINC, G.O.B. Foreign	ton £88 15s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 2s 4⅝d
Sheet	ton £305 15s 0d
Wire	lb 3s 0⅝d
PHOSPHOR BRONZE Wire	lb 4s 6⅛d
PLATINUM	oz £29 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 26½d—26⅝d

Copper Price Stabilization

As a result of proposals made by the British Non-Ferrous Metals Federation, Roan Antelope Copper Mines, Ltd., and Mufulira Copper Mines, Ltd., have offered fixed prices for copper to their customers in the United Kingdom. Prices will be fixed initially for a period of thirty days and then be subject to alteration at 24 hours' notice and stabilized for a further period.

In a statement welcoming the copper companies' decision British Insulated Callender's Cables, Ltd., mention the detrimental effect of the recent wide variations in the price of copper both upon users of the metal and upon the national economy. The company says that while there may be initial difficulties in operating the scheme it will make every endeavour to assist in the successful introduction of stable prices throughout the copper industry.

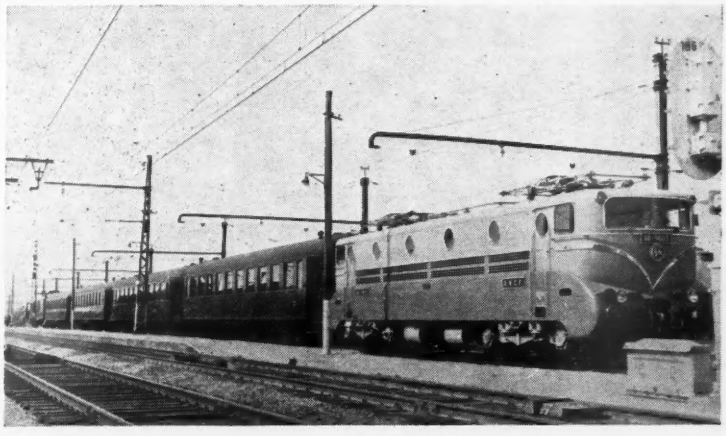
Employers' Warning to Erectors

Last week steel erectors engaged on the construction of the Tilbury (Essex) power station were warned by their employers, John Thompson Water Tube Boilers, Ltd., that unless they stopped their obstructive tactics they would be dismissed. The company stated that since the work at Tilbury began about fifteen months ago there had been a loss of about 25 per cent of productive time and a further loss through restrictive measures adopted by the erectors. Other employers on the site had had similar experiences.

The men's union, the Constructional Engineering Union, had carried out its obligations and taken every step to right the situation even to the extent of withdrawing the credentials of their shop stewards on the site who had refused to carry out the union's instructions.

Radio-Controlled Train

Successful French Trials



The first radio-controlled train hauled by French Railways electric locomotive BB 9003

ON 18th April a train composed of four carriages hauled by the French Railways BB 9003 electric locomotive and without a driver or passengers reached a speed of 74·5 m.p.h. between Connerré-Beillé and La Ferté Bernard on the main line between Paris and Le Mans. This locomotive is a sister engine of the BB 9004 which three weeks previously reached a new world record rail speed of 205·6 m.p.h. Running alongside on a parallel track was a diesel railcar carrying Monsieur Corniglion-Molinier, French Minister of Public Works and Transport, and principal French Railways officials and engineers.

Orders to release the brakes, to control the supply of current to the traction motors of the locomotive, and to apply the brakes at the end of the run, were given verbally by radio telephone from the accompanying railcar to a radio control post set up on the substation at Sceaux-Boëssé about halfway between the starting and finishing points of the run. The radio wave transmissions to carry out these orders were made from the control post to a receiving set which actuated a relay on the locomotive which, in turn, set the necessary mechanisms in motion.

Starting and acceleration up to maximum speed is automatic, and only two types of remote control are necessary, one to operate the brakes and the other to regulate the supply of current to the traction motors. Two kinds of current are necessary for the transmission of orders to the robot train. One of the orders is given by the carrier frequency without modulation and the other by the carrier frequency with modulation at approximately 1,000 c/s. The wavelength used is 1·9 metres.

For these trials which were prepared in a few days only, existing equipment had to be used, that is to say radio telephone apparatus adapted for radio control. This equipment gave excellent results during the preliminary trials. With special equipment designed for the purpose, complete reliability is certain.

The French General Post Office, which made the necessary frequencies available for these trials, gave every other assistance in its power to ensure their success. The French electrical manufacturers who have collaborated with the railways for the provision of radio communications are the Société Française Radio Electrique for the Hirson-Charleville line, and the Société N.O.R. for the Bordeaux-Dax speed trials and the present radio control trials. These radio control trials, which were supervised by Monsieur Fernand Nouvion, an engineer of the Electric Traction Research Department of the French Railways who also co-ordinated the world record speed trials south of Bordeaux at the end of March last, were entirely successful.

OIL AS FUEL

UPWARDS of 700 members and guests of the Institute of Fuel attended the annual luncheon held on 28th April under the presidency of Dr. W. Idris Jones. The first item of the programme was the conferring of honorary membership on Sir Ernest Smith (past-president) and presentation of the Melchett Medal to Dr. A. Parker (Department of Scientific and Industrial Research) and the students' prize to Dr. S. Thomas. Good wishes were expressed to Sir William Larke on having reached his eightieth birthday. The election of Mr. R. H. Gummer as president for next session was announced. Dr. Idris Jones then briefly proposed the only toast, that of the guests, for whom Mr. C. M. Vignoles (Chairman, Petroleum Industry Advisory Committee) responded. Mr. Vignoles referred to the improved oil prospects since the removal of the tax in 1946, which made it an economical alternative to coal. The coming of atomic energy for power production would not prevent oil from playing an increasing part.

At present oil provided 51 per cent of the world's total energy requirements compared with 24 per cent in 1938. The figure for the United Kingdom was now 15 per cent. Owing to its higher efficiency of utilization on the railways, one million tons of diesel oil could take the place of 5 to 6 million tons of coal used by steam locomotives. The higher calorific value and highly radiant flame of oil gave it an advantage over coal of more than its 1·5 to 1 thermal quality, e.g. 1·9 to 1 overall. For the Central Electricity Authority power stations comparison would be more on the basis of calorific value above. Since 1946 the consumption of oil in the United Kingdom had almost doubled. The capital expenditure of the oil industry was heavier than could be financed by the money markets of the world (a large proportion going to exploration of new oilfields) and the industry had to be largely self-financing out of profits.

New A.P.L.E. Section

ON Tuesday last week the new South Western Section of the Association of Public Lighting Engineers was inaugurated at Bristol. Mr. L. Doxey, president of the Association, was unable to attend, but Mr. E. Evans, the secretary, was present. A committee was elected and future activities were discussed. After the meeting a technical film show was given. The Section chairman is Mr. N. Axford (South Western Electricity Board); the vice-chairman, Mr. J. B. Bennett (city engineer, Bristol); and the hon. secretary and treasurer is Mr. F. H. Pulvermacher (South Wales Electricity Board).

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Modern Meter Testing

IN his article on the above subject (*Electrical Review*, 22nd April) Mr. Petch claims that meters of different speed characteristics can readily be " batched up " and tested by the stroboscopic method allied with the multi-range current transformer. Surely this method has been in use for some considerable time. Mr. Petch's statement that manufacturers using stroboscopic testing have an advantage because they are able to test batches of meters with similar speed characteristics is possibly correct, but large testing stations will have no trouble in making up batches of similar meters for test. It is only on rare occasions that a " mixed bag " needs to be tested.

The counter system appears to have merit but could possibly suffer in accuracy, I presume, from variable mains frequency. I can see no merit, but the contrary, in reducing the low load test to less than one revolution of the disc.

Mr. Petch appears to object to a dial test carried out on load, as this takes up so much time. Would he therefore advocate the American routine of testing the counters mechanically before fitting them to the meters? By what routine would he propose to satisfy the Meters Act requirements in so doing?

Monkseaton, Northumberland. C. H. FORSTER.

Electric Light Fittings

SURELY Mr. Croft is being a little less than fair to persons skilled in the art of illuminating engineering when he seeks to apply to them the strictures of Mr. Lennox relating to those who undertake the design of lighting installations with no real knowledge of the subject.

Your readers will not need to be reminded that the president of the Illuminating Engineering Society is in no way connected with the manufacturing side of the industry, but no doubt they will agree on the need to call attention to the ill use of well designed fittings, which is only too common.

As to the provision of photometric and other technical information, while Mr. Croft's charges may well be true in respect of some firms, I am sure it will be well known to your readers that the members of this Association possess the finest photometric and research laboratories and can provide unrivalled technical information and advice about their products and on all problems of illumination.

London, W.C.2. J. H. CAMPION,
Secretary,
Electric Light Fittings Association.

Church Heating Installations

BRIEFLY replying to Mr. A. R. Lash's letter in your issue of 22nd April, I would assure him that the basis of design and layout for a church heating installation (used on Sundays) is just exactly the point he considers I have missed, i.e., to keep the congregation warm and not attempt to warm the structure.

In respect of his final paragraph, I agree that it would be presumptuous to estimate a heat load on floor area only, if space heating was envisaged, but I clearly referred to comfort conditions which again means keeping the congregation warm and not the building.

These points emphasize how very inefficient is the electrically heated hot water installation described in your issue of 11th March, compared with direct electric heating, and all the more so if I read Mr. R. L. Gaunt's letter correctly (*Electrical Review*, 15th April). This indicates to me that the boiler equipment is on circuit for nearly 24 hours in very cold weather, or 12 hours in normal weather, all to provide for an occupation period of only a few hours, as against a pre-heating period of 4-5 hours, or 2-3 hours respectively for the usual direct electric system.

Welwyn Garden City. C. B. CLELAND.

Noteworthy Staff Suggestions

WITH all respect to the authors of the suggestions mentioned in the article under the above heading in your issue of 22nd April, it would seem that some of the ideas are simply re-discoveries of systems in operation in some localities several years ago.

It was standard practice, for example, with at least two local undertakings to take the neutral of an overhead service to the meter direct. When, after nationalization, links were introduced it was thought that their purpose was to facilitate disconnection.

The turnbuckle " come along " system of tensioning, too, was in common use. However, when B.E.S./L.1 was made the standard reference and nut-type line-taps were used more efficient systems were evolved. One such system is to take the first conductor at a l.v. construction up to sag and bind it in, using a straining device (" pul-lift " for example). The next conductor is then brought up to answer the first. The linesman judges how much is to be lost in making off and takes this amount up, makes a neck and line-taps the loose end to the main. The straining device is then dropped to the next conductor to repeat the process. The sags can then be seen to be correct before binding-in takes place. By dealing with the conductors individually all that is required is a handful of line-taps, a pulley-block and a straining device (two on a section).

Because of the wider application of cone-type terminating clamps on h.v. lines a lifting device shackled to the clamp will give a sag quite effectively.

Bridgend, Glam. H. SOMERS.

Metal Fatigue

THE Council of the Institution of Mechanical Engineers is arranging an International Conference on Fatigue of Metals to be held from Monday, 10th September, to Friday, 14th September, 1956, inclusive. Sessions for the delivery of papers will be held daily from 10 a.m. to 12.30 p.m. and from 2.30 p.m. to 5.30 p.m.

It is hoped to obtain up to sixty papers covering the whole field, and these will be divided into groups, the papers in the various groups being presented for discussion in abstract form by reporters. The presentation of the papers will be preceded by an address reviewing the field of knowledge of fatigue. The address will be presented by Dr. H. J. Gough, C.B., M.B.E., F.R.S., a past-president and honorary member of the Institution.

British Industries Fair

Twenty-ninth Display Opened in Birmingham and London

THE calling off of the threatened rail strike was a great relief to everyone associated with the British Industries Fair, which was opened in both London and Birmingham on Monday. For the first time the Fair as a whole had a formal opening ceremony and this was performed at Olympia by Admiral Earl Mountbatten, who said that the Fair was vitally important, for Britain's well-being still depended on how effectively we worked and sold. Although we could now afford greater emphasis on more production and consumption this would never be at the expense of our export drive. It was the policy of the Navy to use the resources of industry to the maximum extent possible in the solution of its technical and manufacturing problems.

Speaking at the Government banquet at Mansion House on Monday night, Mr. Peter Thorneycroft, President of the Board of Trade, said that the volume of exports last year increased by six per cent, and for the first quarter of this year they showed a still greater increase. We were giving to our customers what they required and were selling at prices people were prepared to pay.

The Duchess of Kent was to visit the Fair on Wednesday, the Duchess of Gloucester yesterday (Thursday) and the Queen and the Duke of Edinburgh will make a tour of the Fair on Tuesday next.

At the opening luncheon at Castle Bromwich, the Lord Mayor of Birmingham, Ald. J. R. Balmer, said that Britain was enjoying a period of prosperity but there was no room for complacency. Mr. C. A. F. Hastilow, chairman of the Management Committee of the B.I.F., emphasized the importance of export trading in maintaining present prosperity. Earlier this year, all indications were that the industrial barometer was set fair. Trade was booming and order books were full. But we had been warned that our balance of payments situation gave some cause for disquiet, and it had been made abundantly clear that once again the accent was to be on exports. The long-term prestige of a firm was almost as important as sales and although there was very often no way of finding out how many inquiries came from exhibiting at the Fair, it was reasonable to assume that a good proportion did so.

Left: The "Electrical Review" stand at Castle Bromwich. Below: The theme of the British Electrical Development Association's joint exhibit with the Midlands Electricity Board is greater productivity in the glass industry

BRITISH INDUSTRIES FAIR

EQUIPMENT FOR INDUSTRY

THE general theme of the displays in the electrical and engineering sections at Castle Bromwich this year appears to be diversity of electrical application. Increasing productivity is often the reason for performing a function electrically and many exhibits are to be seen which come into this category. Others show what the electrical industry can do to help other industries perform their tasks more easily and efficiently. Although the electrical section is much smaller than it has been in previous years there are, nevertheless, a good number of items of interest to the potential industrial user of electrical equipment and methods.

In the aircraft and motor car industries windscreens of laminated glass, with invisible electrical heating elements built into the glass are used for de-misting and de-frosting. Research is in progress on a further development by which it is hoped to deposit a transparent metal coating on the glass to serve the same purpose. Examples of such windscreens, made by the Triplex Safety Glass Co., are shown on a stand arranged jointly by the British Electrical Development Association and the Midlands Electricity Board, which this year is devoted entirely to illustrating the place of electricity, now and in the future, in the British glass industry.

In the United States, the industry is already extensively electrified, and looking to the future many British firms are adopting electrical methods of annealing and melting, apart from electrically driven machines for cutting, grinding, polishing, engraving and toughening. In most glass factories to-day annealing is carried out in electrically heated lehr tunnel ovens, through which the glassware travels on conveyors. Up to 1,400 deg C is required in glass melting and this temperature can be achieved with electric furnaces which, providing a flameless, fumeless heat with a clean atmosphere in the furnace, are likely to be increasingly used in the production of glass, particularly scientific and other glass in which maximum purity is essential. Two electric glass furnaces are shown on the E.D.A.-M.E.B. stand, one of them a "gloryhole" oven made by Bernard W. E. Webber for re-heating glassware in the production of cut glass, with a complete absence of sulphur fumes, a necessary condition for this type of glass. On loan from the Stafford works of the English Electric Co., Ltd., is a high-frequency welder which is used to weld metal to glass in the production of radar valves. Other demonstrations and displays on the stand cover the whole range of glass production including melting, annealing, strengthening, toughening, bending, engraving, handling, conveying and lighting.

Instead of fastening on to one industry the General Electric Co., Ltd., is portraying the diversity of industries to which it is capable of supplying electrical equipment, the principal headings being power generation and its industrial utilization, electronics and communications, lighting and domestic equipment. On the power side a mural depicts transmission towers as a background to three large illuminated colour transparencies which illustrate the ability of the company to carry out complete power station schemes. One shows the Orlando power station of the Municipality of Johannesburg, for which the G.E.C. is supplying generating plant with a total capacity of 375 MW. Another shows a 45 MVA 132/33 kV transformer in service at the Oldbury substation of the C.E.A., while the third illustrates switchboards in the control room of Nechells "B" generating station.

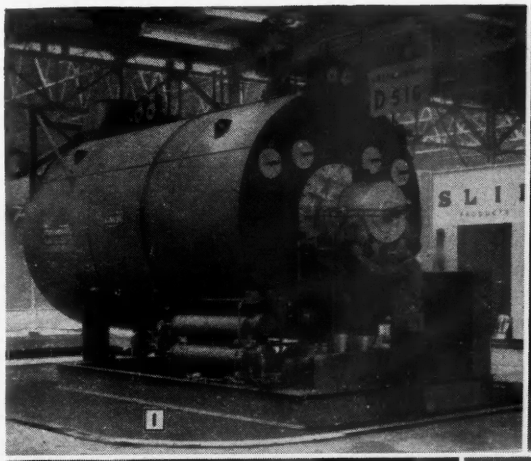
During recent years the gas turbine has been increasingly used as a prime mover for electrical generators. A particularly interesting turbine is shown by Rover Gas Turbines, Ltd., and it can be used for a variety of applications other than power generation. It has a very good power to weight ratio; for a continuous rating of 60 b.h.p., the total weight, including starting mechanism, is only 130 lb. Coupled with this low weight, the small size of the unit means extreme compactness and portability. On the stand is a Petbow 50 kVA alternator set incorporating the Rover gas turbine, the whole unit weighing only about 1,250 lb. The exhaust heat available is about 1,250,000 B.Th.U/hr at the normal jet pipe temperature of 600 deg C; it can be used either for space heating or for specialized purposes. More conventional types of generating plant are shown by A. C. Morrison (Engineers), Ltd., with outputs ranging from 350 W to 25 kVA. An interesting item here is a 500 W petrol/kerosene flange mounted portable generator which is light enough to be carried by a girl. It is intended primarily for service departments and the power unit or generator can be replaced extremely rapidly upon removal of only four bolts.

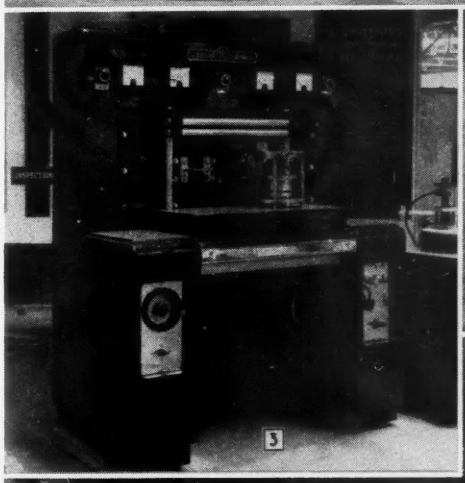
Electric motors are now used in such large numbers and for such a wide diversity of duties that they are treated as standard items of equipment. It is only during recent years, however, that any real attempt at standardization has been made between British manufacturers. This point is illustrated by Higgs Motors, Ltd., who are showing a new range of totally-enclosed squirrel cage motors known as type UB using the dimensions given in B.S. 2083: 1954. This firm is also showing a number of machines which have been produced with the export market in mind.

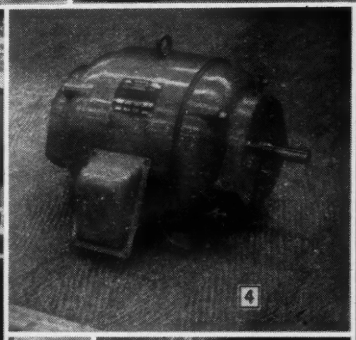
In this direction Brook Motors, Ltd., have a selection of motors in various enclosures, including the British Standard drip-proof and fan-cooled range, with similar designs to N.E.M.A. specifications for the American and Canadian markets. The company is prepared to assist machine makers exporting motorized plant to the American continent and this is backed by stocks of spares and replacements from Brook agents under the supervision of the Brook Motor Corporation of Chicago.

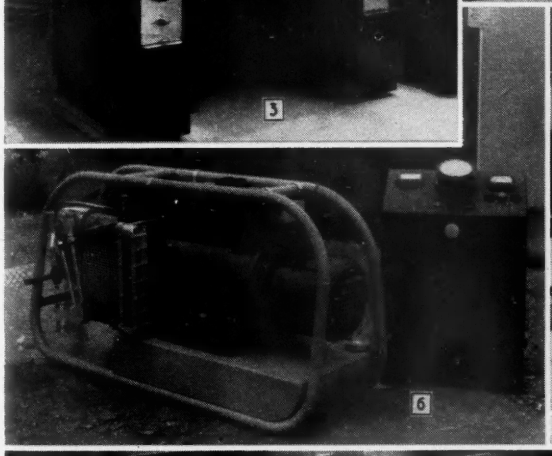
Special purpose motors are to be seen here and there at Castle Bromwich and typical of these is the "Luton" range of single- and three-phase f.h.p. motors made by George Kent, Ltd., in sizes up to 0·5 h.p. and universal motors of up to $\frac{1}{8}$ h.p. which can be supplied to operate up to 10,000 r.p.m. Of the a.c. and d.c. generators shown by B.K.B. Electric Motors, Ltd., in sizes up to 20 kVA special emphasis is placed on flange mounted machines for close coupling so that maximum advantage can be gained from the available prime movers. On the mechanical side there are all sorts of accessories which find application with electric drives and a number of advances in design have been made. For instance, J. H. Fenner have conducted research which has enabled them to use appreciably

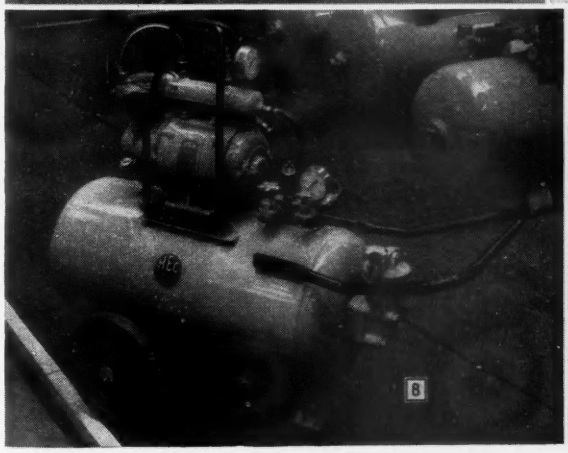
1. G.W.B. "Powermaster" oil/gas fired boiler. 2. G.E.C. mural depicting power generation and utilization. 3. English Electric high-frequency glass-to-metal welder. 4. Brook 5 h.p. three-phase motor designed to N.E.M.A. specifications. 5. Desoutter "Rackfeed" pneumatic drill. 6. Petbow 50 kVA lightweight gas turbine alternator set. 7. Higgs 250 h.p. vertical slip-ring motor and 250 kVA alternator for export. 8. H.E.C. dual-purpose air compressor. 9. Mono pump for handling dry materials

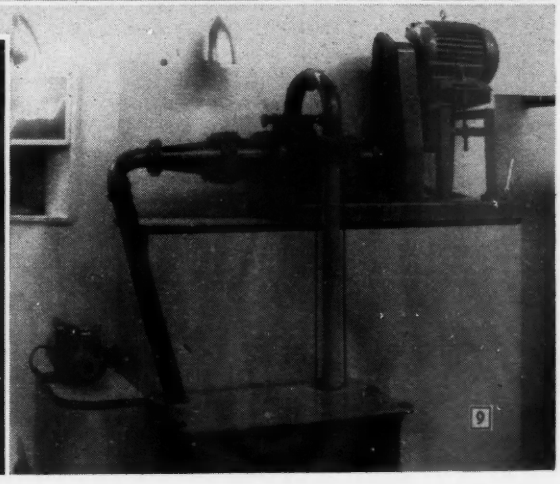












ctric high-
pneumatic
for export.

higher h.p. ratings for their V-belts, while Allspeeds, Ltd., show the $\frac{1}{30}$ h.p. "Kupp" miniature speed variator which has an infinitely variable range of 9:1 ratio and will attain speeds of 18,000 r.p.m.

One of the common uses of the electric motor to provide, in turn, a further source of industrial power, is in conjunction with pumps and compressors. On the pump side Mono Pumps, Ltd., are showing two sizes of the type DM pump for handling dry materials. One is capable of outputs up to 250 cu ft/hr when running at 300 r.p.m., the power requirement being about 2 to 5 h.p. depending upon the physical characteristics of the material being pumped. The other unit is available for outputs up to 100 cu ft/hr at running speeds up to 250 r.p.m.

There are many compressors on view for all manner of purposes. For machine tool operation, requiring pressures up to 150 lb/sq in with very little volume, H.E.C. Compressors & Engines, Ltd., have several special units. For example, model D.S.B. comprises a $\frac{1}{2}$ h.p. motor direct-coupled to a $2\frac{1}{2}$ cu ft compressor with equipment such as balance chamber, pressure gauge, relief valve, etc. This model can also be supplied with a dog coupling for use in cases where it is possible to couple to an auxiliary drive. Both stationary and portable compressors, with all types of drive, are shown by Alfred Bullows, Ltd., with capacities ranging from 3 to 65 cu ft/min. As a result of recent development work the efficiency of these machines has been raised considerably.

The use of compressed air in industry is demonstrated very well by Desoutter Brothers, Ltd., who have the new "Rackfeed" drill which is designed to simplify drilling and reaming of $\frac{1}{2}$in diameter holes and over, enabling the work to be carried out by unskilled operators. Its main features include a geared hand feed which eliminates fatigue and enables the depth of penetration to be accurately controlled by means of an adjustable depth stop on the rack.

Heating is of major importance in almost all industries and G.W.B. Furnaces, Ltd., have on view the smallest and the largest in their range of "Powermaster" oil/gas fired boilers. These two units give outputs of 517 lb and 17,250 lb of steam per hour respectively. Both boilers are completely self-contained packaged automatic units for raising steam up to 250 lb/sq in and for water heating. The same firm is also showing its packaged "Autolec" electrode type boilers.

One of the best methods of increasing productivity in industry is to ensure accuracy of control at all stages of the processes involved and without the electrical methods and equipment which are available to-day industry would be in a sorry state. The solenoid operated valve is a simple thing, but it overcomes a multitude of difficulties in many applications. Several types are shown by Alexander Controls, Ltd., for all types of liquids and gases at pressures up to 200 lb/sq in and temperatures up to 400 deg F. Among the items of interest shown by Tomey Industries, Ltd., are pressure switches which can be arranged to make and break at any predetermined pressure but can only be run off a 12 V or 24 V battery circuit. Also on the control side there is a two-stage automatic controller shown by the Sigma Instrument Co., Ltd., which is designed to stop the in-feed of a machine precisely when the component reaches the correct size, and is noteworthy for its versatility and high accuracy.

In another field the English Electric Co., Ltd., is demonstrating an electrically operated actuator for the remote control of boiler dampers. Remote control is a very broad subject, but a good selection of equipment and components, such as relays, etc., are displayed by Electrical Remote Control Co., Ltd. Relays and allied devices are also shown by the Donovan Electrical Co., Ltd., together with a number of special purpose control panels. Apart from a wide diversity of relay operated equipment Londex, Ltd., has an electronic batch counter operating at speeds up to 500 per sec which demonstrates how four batching operations per sec can be dealt with. This unit receives impulses either from a mechanical or photo-electric source and displays the count on Dekatron tubes.

Potentiometric programme controllers are shown by the Foster Instrument Co., Ltd., alongside the latest types of electronic continuous balance potentiometric indicators and recorders. These instruments have been designed to cover a wider field of application in research and industry than is possible with the millivoltmeter type of instrument and they can be fitted with various forms of control contacts for automatic temperature control. The control equipment shown by the Westinghouse Brake & Signal Co., Ltd., includes a controller for governing automatically an entire anodizing programme (Benough Stuart process) and a constant voltage d.c. power supply unit. Typical performances of the latter are:—d.c. voltage limits $\pm$ 1 per cent despite a.c. mains fluctuations of -10 per cent to $+6$ per cent, frequency variations of 48 to 52 c/s and load variations of 5 per cent to 100 per cent.

In industrial control apparatus generally increasing use is being made of electronic techniques to achieve results which are unattainable by other methods. For instance, Hadley Telephone & Sound Systems, Ltd., have a photo-electric counter of novel design which indicates the number of passengers on the top deck of a bus at any given instant. The equipment takes into account both the passengers who go upstairs and those who come down, thereby saving the conductor a considerable amount of running about.

The inexpensive measuring oscilloscope shown by E.M.I. Electronics, Ltd., will appeal particularly to trade and industrial users, and to technical educational and training establishments. The d.c. coupled amplifiers employed make it suitable for a very wide field of application in connection with radio, television and electronic equipment. The range of voltage measurements covered is 0·2 to 500 V a.c. and d.c.; the deflection sensitivity is 1 cm/V and the maximum bandwidth 3 Mc/s. Another item of electronic apparatus of interest to industrialists is the engine indicator of Southern Instruments, Ltd. This is a single-channel trolley-mounted equipment with universal recording facilities. It provides a means of indicating any internal combustion engine or compressor using condenser, resistance, electromagnetic or photo-electric pick-up by the use of alternative panels. In another field Cinema-Television, Ltd., have a new "Cintel" industrial electronic metal detector which will indicate the presence of any metal, ferrous or non-ferrous, in any non-metallic product and automatically eject the product containing it or otherwise give an alarm.

In most of the manufacturing industries electro-plating is carried out to some extent at least and one of the foremost manufacturers of this type of equipment, W. Canning & Co., Ltd., is showing the "Rotamatic" constant-speed continuous-circuit plating unit. It is designed to allow the work to be plated to travel forward 2ft and then back 1ft. Thus although a 3ft travel has taken place during the

1. A.G.B. conveyor-elevator for the National Coal Board. 2. Southern Instruments electronic engine indicator. 3. "Sigmatrol" automatic machine controller. 4. E.M.I. type WM1 measuring oscilloscope. 5. Londex electronic batch counter. 6. Hadley bus passenger counter. 7. Canning "Rotamatic" plating unit. 8. Foster potentiometric programme controller. 9. Wolseley battery operated electric fencer. 10. The "Hyloveyor" and "Loband" loader in operation. 11. Westinghouse constant voltage d.c. power supply unit

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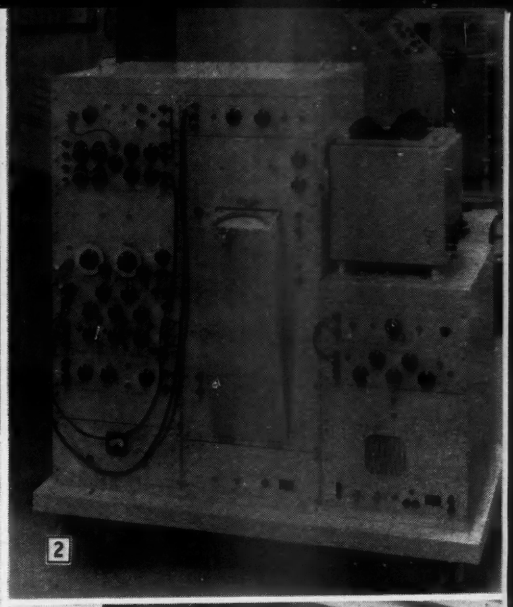
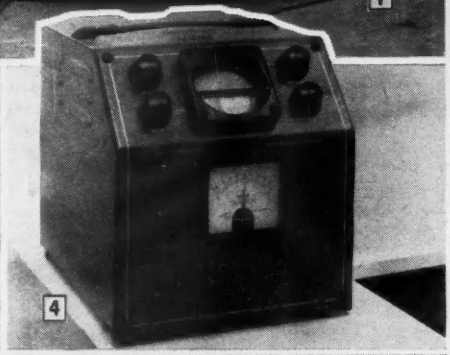
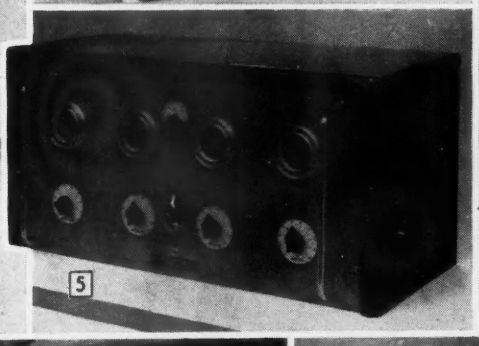
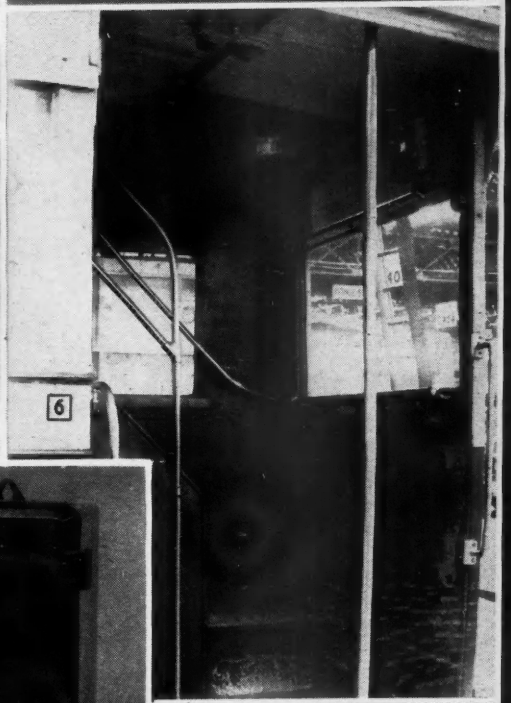
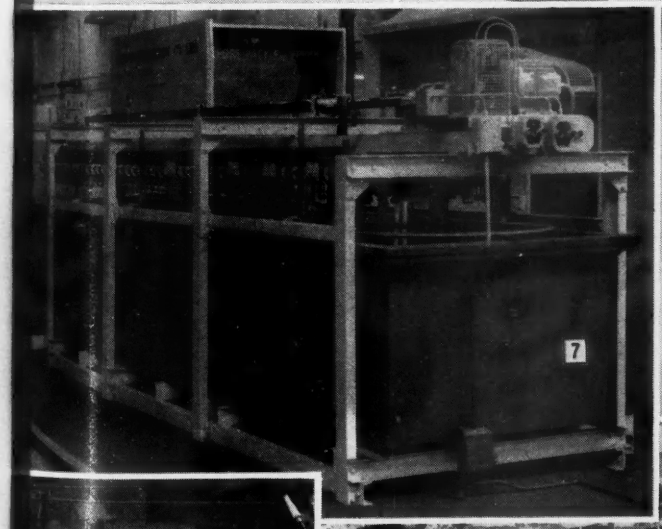
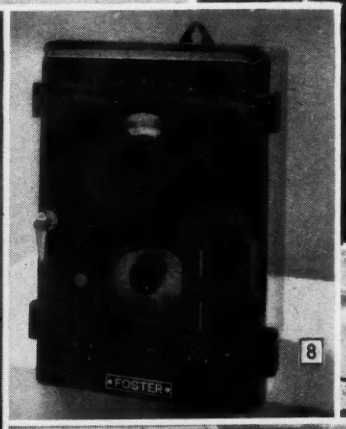












cycle, there is only 1ft of forward travel. This "pilgrim step" movement takes place in the same period of time required for 1ft of travel in the normal "Rotamatic" circuit. This is of great advantage when producing quality plating. Plating rectifier equipments are shown also by the Electric Construction Co., Ltd., including the 150,000 A units as used for the electro-tinning lines at the Trostre works of the Steel Company of Wales.

Materials handling and conveying equipment probably contributes more to increasing productivity and industrial efficiency than anything else and it is a surprising fact that most of this type of equipment requires very little

1. Yale and Towne electric tractor with three-speed control. 2. Alexander servo-operated valve. 3. Rapid Magnetic Machines induced roll mineral separator. 4. Lister 1,000 lb capacity "Auto-Truck." 5. Lansing Bagnall pedestrian controlled pallet truck. 6. Brush 33 kV on-load tap-changer illustrating the uses of "Permali" and "Dialam." 7. Greenwood and Batley 2-ton battery-electric locomotive

power to drive it. As in previous years a very wide range of materials handling plant is on view at Birmingham. On the stand of G. R. Turner, Ltd., there is an " A.G.B." conveyor-elevator made for the National Coal Board in only eight weeks through the co-operation of the Fluidrive Engineering Co., the Metropolitan-Vickers Electrical Co., Ltd., Ransome & Marles Bearing Co., Ltd., Super Oil Seals & Gaskets, Ltd., and the United Steel Companies, Ltd. This prototype underground conveyor-elevator has a 350 tons/hr capacity, is driven by a 45 h.p. flameproof induction motor, and is capable of negotiating small radius bends in both the vertical and horizontal planes.

Several conveyors are demonstrated by Fisher & Ludlow, Ltd., including the new " Flowmaster," an overhead chain conveyor, which is completely controllable by push-button. The circuit on view carries eight trolley units with pre-selector gear. The control of this conveyor is most flexible; the automatic release from the parking stations can be stopped if required, so that all carriers may be returned to their starting points, and trolleys can be pre-set by push-button to over-ride the work station and carry on straight through the circuit. In a different field C. H. Johnson (Machinery), Ltd., have the " Hyloveyor " and " Loband " loader combination, which is ideal for the quick transfer of bulk materials from tipping truck to stock pile. This is done in one operation and eliminates the need for power shovels or grabs.

Electrically operated hoists are to be seen in large numbers on the stands of such firms as Herbert Morris, Ltd., and Felco Hoists, Ltd., while electromagnetic lifting and separator equipment is shown by Electromagnets, Ltd., together with its patented " Selectoload " control system. The latter is demonstrated in conjunction with a rectangular lifting magnet selecting thin steel plates individually, a difficult task before the introduction of this new control system. Apart from allied equipment Rapid Magnetic Machines, Ltd., have on view an induced roll mineral separator which is designed for the purification and concentration of dry, granular, free flowing, feebly magnetic material such as silica sand, abrasives, etc.

Alongside a number of battery operated portable electric fencers the Wolseley Sheep Shearing Machine Co., Ltd., has a mains operated unit for use in connection with permanent or semi-permanent installations, e.g., in piggeries, etc. Safety has been the primary concern in designing this unit, the output of which accords in all respects with the international safety regulations governing such equipment.

Electric Vehicles

Turning now to industrial electric vehicles, the fork-lift truck is possibly one of the greatest savers of man-power and time in the factory. Typical of these machines is the 1,000 lb capacity fork-lift " Auto-Truck " shown by R. A. Lister & Co., Ltd. Elevation from the minimum height of 2½in to the maximum of 9ft is achieved in about 20 sec. The PP230 pallet truck of Lansing Bagnall, Ltd., is claimed to be the most compact power unit in the world (only 17½in overall) with a capacity of 3,000 lb, so that its length with standard 36in forks is only 53½in. Conveyancer Fork Trucks, Ltd., have re-styled a three-wheel 2,000 lb capacity, 20in load centre truck, while Greenwood & Batley, Ltd., have a 24in gauge 2-ton battery-electric locomotive with a drawbar pull of 360 lb at 4 m.p.h. and a starting drawbar pull of 700 lb. Also in this section the Yale & Towne Manufacturing Co. have a battery-electric tractor fitted with a three-speed control to give operating speeds in excess of 5 m.p.h.

On the stand of Permali, Ltd., is a Brush 33 kV, 400 A, three-phase, reactor type on-load tap changer, which incorporates " Permali " selector switch fixed contact panels, operating shaft and " Dialam " double concentric divertor switch load bushings. A very good display of laminates, sheets, tubes, rods and components is also to be seen on the stand of Tufnol, Ltd.

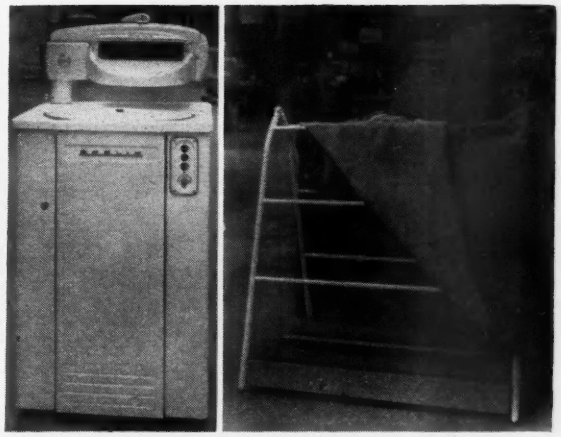
The Transformer & Electrical Co., Ltd., is showing on stand 736A flash test units, rectifiers, oil- and air-cooled transformers and l.v. units, ranging from 10 VA to 100 kVA.

Finally, we come to insulating materials and here the Imperial Chemical Industries, Ltd., has a number of working models demonstrating the various properties of silicones. A small silicone resin insulated transformer is also shown operating in a water bath and a 3 h.p. silicone insulated motor is run with its windings at a temperature of about 180 deg C. The wide range of plastics shown by Bakelite, Ltd., include thermosetting and thermoplastic moulding materials, laminates, extrusion materials, resins and adhesives. In addition to paper- and fabric-based laminated sheet, rod and tube, there are grades based on densified wood for jigs and tools, on glass fabric for a combination of improved strength, heat resistance and electrical properties, copper-clad grades for the production of printed circuits, and impregnated wood for electrical applications.

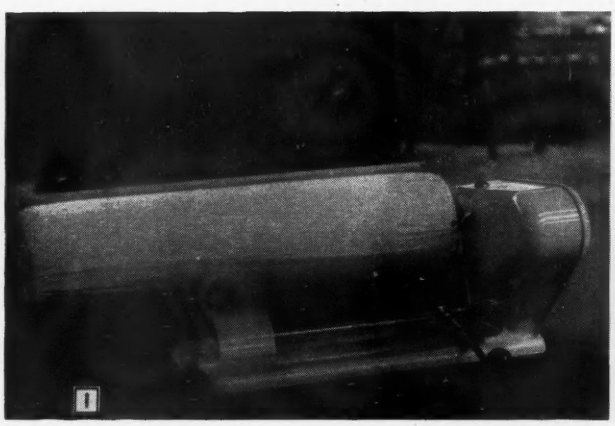
DOMESTIC APPLIANCES

VISITORS to the Fair will no doubt be disappointed in the numerically small display of domestic electrical appliances to be found this year, but nevertheless there are still several items of interest including a few that are being shown for the first time. Among the four outstanding examples of British achievements in engineering and research shown on the Department of Scientific and Industrial Research stand is the Brentford " Duo-Therm " heat pump described on p. 763 of this issue.

Colour is the keynote in modern kitchen furnishings and this is exemplified on the stand of C.S.A. Industries, Ltd., manufacturers of the " English Rose " kitchen equipment, who this year introduce the " Anemone " range. Providing the appliances that go to make up the kitchen unit, refrigerators, cookers, boilers, washing machines, etc., are either white or pale cream it is left to the new



(Left) " Goblin " model W140 washing machine. (Right) Campbell Engineering " Hotway " collapsible clothes dryer



1. Oprim "Super 22" rotary ironer. 2. Bendix automatic home washer together with the C.S.A. "Anemone" sink unit

furnishings to provide a consistent colour motif throughout the kitchen.

Apart from improvements in safety features, guards in particular, there are signs in heating appliance design of the attention that is being paid to the further increase in efficiency. The fascination of burning coal or logs without the attendant dirt and dust can still be experienced with the use of "Magicoal" fires, the latest addition to the range being the No. 20 "Regency" 2 kW model which is available in an antique bright rustless finish. Berry's Electric, Ltd., also shows "Raydair" low-temperature heaters in which the element is so completely screened that it can be used in the nursery with perfect safety. Models for use in the greenhouse take up little space and can be obtained in either 750 W or 1½ kW sizes. A redesigned version of the "Cromwell" fire, introduced by Bulpitts, has two chromium parabolic reflectors and attractively styled safety grid. This is available in antique brass or armour bright finishes. L. G. Hawkins now have a 2 kW model of their recent "Marilyn" fire and another single-bar fire is fitted with adjustable ball feet for angle of reflection. A convenient feature is that the legs can be folded away for storing or packing. Convector heaters, incorporating an imitation coal effect are also to be seen on the stand of P. R. Weaver, Ltd.

The liability of moulded kettle handles to break before the appliance has normally finished its service life has been noted by manufacturers, and the Bulpitt "Royal" range now has redesigned handles consisting of a continuous metal band on to which is moulded a comfortably shaped handle. L. G. Hawkins also fit reinforced handles to their kettles. While on the subject of handles it is interesting to note that sales of the aforementioned company's irons have considerably increased since it produced models with cherry and maroon coloured handles in addition to the usual black.

A modified castor assembly for their oil-filled radiators is being shown by Dimplex; this is going into production immediately, greater stability and interchangeability being the main features. Single- and double-sided chromium towel rails will in future be made for the 1¼ and 1½ kW models and these are displayed for the first time.

Somewhat less refrigeration equipment is to be seen this year. The G.E.C. 8 cu ft model is of interest to the overseas visitor, it having more than 15 sq ft of shelving and a freezer capacity of 40 lb. The new L.E.C. P.42 refrigerator shown on the C.E.A. (Distribution), Ltd., stand is most advanced in design; it is only a 4 cu ft model, yet incorporates several of the features of the larger American types, reduced in size for the British housewife. A plastic butter keeper, egg racks and bottle compartment are embodied in the door and it also incorporates a freezer locker. Finish is in white or cream.

Home laundering equipment is well represented and apart from already well-known products, including the Bendix and G.E.C. washing machines, there are several innovations. Well known for their stainless steel kitchen units W. H. Paul, Ltd., now incorporate a heated washing machine in their single and double draining board sink units. Permanently fixed in the sink cupboard, it is only necessary to lift the working top and raise the hinged wringer to bring it into operation. The new W.130 and W.140 "Goblin" washers are both equipped with a 2½ kW heating element, and the latter also has a powered 12in wringer and pump. Another innovation is that the agitator is constructed of white indiarubber. The Scales "Fairy" machine now has an aluminium extension mangling tray fixed to the wringer and the de-luxe model incorporates a stainless steel wringer.

After the wash the drying of clothes can sometimes present a problem on wet days and to this end the new Campbell Engineering "Hotway" clothes dryer helps. It has a glass insulated 1½ kW black heat element completely protected from the danger of dripping clothes and its aluminium alloy enamelled finish prevents the formation of rust marks. A ventilated tent-shaped cloth cover is zipped over the appliance when in use, greatly speeding the drying operation. The whole unit is collapsible and can be folded away in a small space. Only a few makes of electric irons are to be seen and only one rotary ironer, that of Oprim Sales, Ltd. The Oprim "Super 22" is the latest model in the range and it has a longer roller, is fitted with a warning light and is thermostatically controlled.

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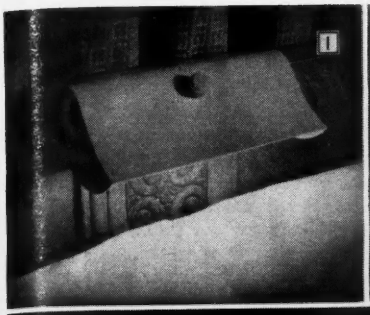
1. P. W. Baker & Sons' bedlamp has five degrees of lighting. 2. Berry's "Adjustalamps" have an infinite variety of positions. 3. One of the McGeoch range of contemporary lighting fittings. 4. Typical examples of the Dimplex range of oil-filled radiators. 5. Berry's "Raydair" 1½ kW greenhouse heater. 6. Brentford "Duo-Therm" domestic heat pump shown in pantry setting. 7. Hawkins "Marilyn" 2 kW fire (left) and the 1 kW adjustable reflector fire. 8. G.E.C. domestic equipment. 9. P. R. Weaver imitation coal effect fire. 10. "De Mille" electric potato peeler. 11. Bescol Electric "Mysto Maid" 3½ pint kettle. 12. L.E.C. P42 refrigerator. 13. Electrix silent "Emperor" vacuum cleaner is designed for use on stairs. 14. Bulpitt redesigned 2 kW "Cromwell" fire with whistling kettle and "Royal" kettle incorporating restyled handle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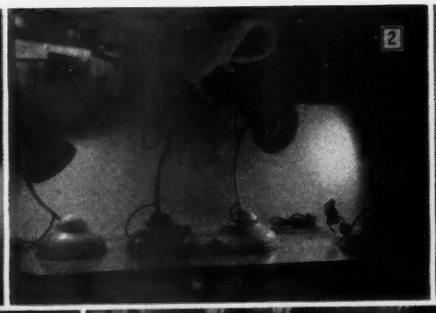
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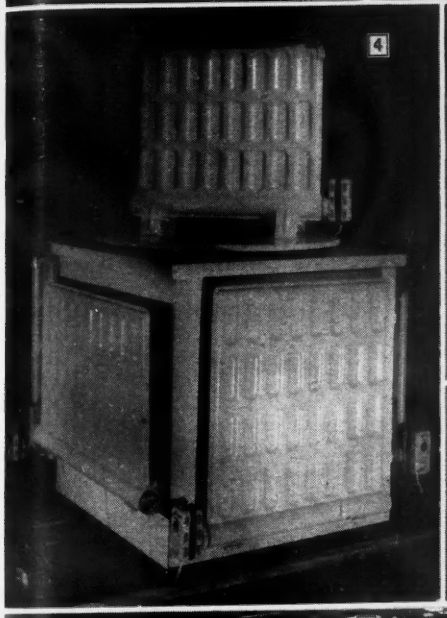
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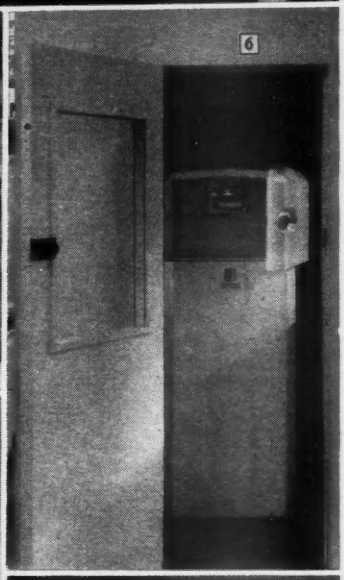
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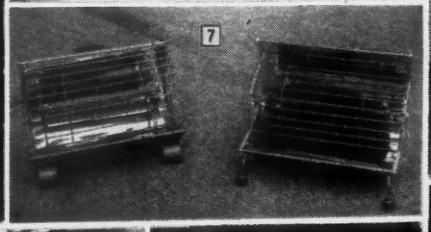
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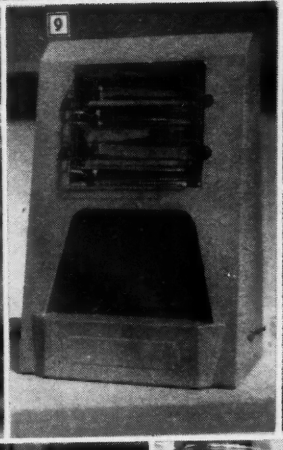
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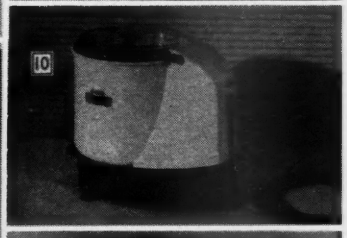
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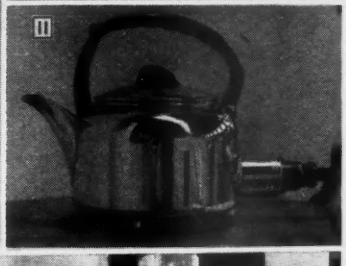
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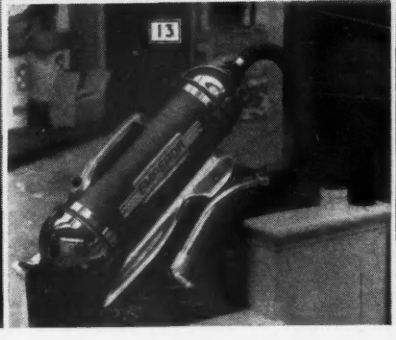
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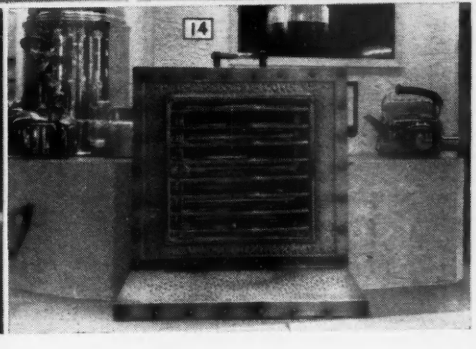
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On the lighting side Wm. McGeoch & Co. have several new contemporary designs for pendant and bracket fitting mostly incorporating pleated conical shades in red buckram. Berry's "Adjustalamps" have an infinite variety of positions and should be of value for localized lighting whilst other persons may wish to watch television programmes. Four finishes include contemporary red and yellow, and also black and gold. The bed lamp of P. W. Baker & Sons incorporates a rotary switch allowing five degrees of light ranging from 30 W downwards. The same lamp can also be adapted to serve as a T.V. light.

Bescol Electric, who now manufacture the "Mysto Maid" range of domestic appliances, have a comprehensive display of fires, toasters, coffee percolators, whistling kettles, etc., including a new 3½ pint kettle.

The task of peeling potatoes is simplified for the larger household by means of the "De Mille" electric potato peeler. Claimed to wash and peel 7 lb a minute, it is compact and portable and fitted with a transparent lid so that the extent of peeling can be observed and wastage avoided.

For the home handyman two new accessories to the Wolf "Cub" range have been introduced, a high-speed bench planer and a bench sander. S. N. Bridges, in addition to their "Nu-Shear" hedge trimming attachment for use with ¼in portable electric tools, now announce the "Nu-Mixer" food mixing attachment. Electric paint scrapers are shown by the Osborn Mfg. Co., and Skarsten Mfg. Co., the last mentioned company having an appliance which has a detachable heating element allowing the user to manipulate it in the ordinary way. Gardeners will be interested in two new electric lawn mowers, the J.P. Engineering Co.'s "Maxees" and "Monarch" which are available in 12in and 14in roller sizes.

Included among wiring accessories introduced by Clang, Ltd., are a neat 13 A twin socket in flush or surface patterns, a 13 A multi-plug adaptor and 5 A two-pin top-entry switch plugs.

Birmingham College of Technology

Diamond Jubilee Celebrations

THE Diamond Jubilee of the College of Technology, Birmingham, was celebrated on 30th April. Particular emphasis was laid during the proceedings on the close relationship between the teaching of technology and industry in the Midlands, and Honorary Associateships of the College were conferred on five men who control some of the largest industrial organizations in Great Britain. On the same occasion Associateships of the College were awarded to 128 men and women working in Midland industry who have completed schemes of advanced study in the several departments of the College.

The Honorary Associateships were conferred upon Sir Leonard Percy Lord (British Motor Corporation), Sir Frederick Handley Page (Handley Page, Ltd.), Mr. A. B. Waring (Joseph Lucas, Ltd.), Lt.-Gen. Sir Ronald Weeks, C.B.E. (Vickers, Ltd.), Mr. T. Williamson (National Union of General and Municipal Workers) and Dr. James C. Duff, former Head of the Department of Chemistry at the College.

The presentations took place at the Town Hall in Birmingham before a large audience of industrialists connected with the College of Technology, representatives of the city, of the University of Birmingham, and of other technical colleges in the locality. The principal, Mr. J. Wilson, referred to the dynamic state of technological education at the present time, but added that the extension of knowledge and its application could not stand alone as the guiding motives for an institution such as theirs. It was more likely that a student well qualified academically might be a failure because he had not also studied men.

It was to prevent this that the new "sandwich" courses in technology had been launched by the College in all its main departments, which enabled company-sponsored men to attend full-time courses in the College for six months of each year and to spend six months in their companies' workshops. Already one company had placed its faith in these courses by arranging for 80 to 100 selected electrical engineering apprentices each year from all its constituent factories to receive their education at Birmingham.

Principal Wilson went on to refer to the new buildings at Gosta Green which would shortly be taken over by the College. He said that there must be new facilities to serve the new industrial age in dealing with the problems of nuclear energy, automation, electronics, plastics, gas turbines, transistors, and many other new branches of applied science.

At a luncheon after the presentation ceremony, the chairman of the governing body, Mr. J. J. Gracie, welcomed a number of distinguished people who had come to take part in the proceedings, including the Bishop of Birmingham; Mr. F. Bray, Permanent Under-Secretary, Ministry of Education; and the Vice-Chancellor of the University of Birmingham. Mr. Gracie said that their ambitions were simple; Birmingham was the heart of the British engineering industry, and the College of Technology was the heart of technological training in Birmingham. By a process of extremely simple reasoning it followed that the College should be the greatest engineering training college in Great Britain—and the governing body would not be satisfied until that ambition had been attained. They were completely confident that if they were given adequate facilities, they had the men for the jobs. The present building and its facilities and equipment were hopelessly inadequate. There was even a distinct possibility that the facilities of the new buildings at Gosta Green would be inadequate before they were taken over.

ELECTRON MICROSCOPY

IN a paper presented before the Institution of Mechanical Engineers on 15th April, Dr. J. S. Halliday (Associated Electrical Industries, Ltd.) showed that reflection electron microscopy, in which the metal surface is viewed obliquely and metal protuberances are seen in profile, can be used for the quantitative study of surface finish. Its range was illustrated by micrographs of electro-polished aluminium, which, over large areas, was flat to 0·1 deg with a highest asperity of 0·4 micro-inch, and of ground hardened tool steel with asperities up to 70 micro-inches high and sloping at 30 deg to the general surface. A fine beam of 50 keV electrons, from an electron gun, is focused on to the surface of the specimen at an angle that can be adjusted by tilting the gun and condenser lens assembly. The scattered or "reflected" electrons through any chosen angle are focused on to a photographic plate by objective and projector lenses.

E.A.W. Conference

Thirty Years of Progress

OVER 600 delegates and friends from all parts of the country, including Scotland and Wales, attended the 30th annual conference of the Electrical Association for Women, which was held in London on Tuesday and Wednesday last week. The theme of the conference was "Progress."

On Tuesday evening a soirée was held at the Royal Institution when Sir Lawrence Bragg, resident professor of the laboratories of the Royal Institution, gave an address on "Thirty Years of Electrical Progress."

Annual Meeting

On Wednesday morning the delegates gathered at the Connaught Rooms for the annual general meeting over which the Dowager Lady Swaythling (president) presided. Before the business of the meeting commenced, the members stood in memory of the late Miss Beth Card, branch development secretary, and Mrs. Alice Coulthurst, area organizer, South-Western & South Wales Areas.

Lady Swaythling then expressed the regret of all present at the absence of Dame Caroline Haslett and paid tribute to Miss V. Norvick, assistant secretary, for the way in which she and the staff had shouldered a great deal of extra work. She read a message from Dame Caroline Haslett in which she said that on looking back she was filled with pride at women's achievements. The E.A.W. had played a notable part in the life of the country; it had added beauty and efficiency to the home and had widened the scope of women's work and in paid careers. The next thirty years would see a solid building on the foundations they had helped to lay.

Miss Norvick presented the annual report which states that since the formation of the Association in 1924 the policy formed then has remained unaltered, and the support then given by the representatives of the educational and electrical worlds has continued ever since.

Reviewing the progress in the branches, the report showed that twelve new branches were formed, bringing the total to 151. The main activity of the year was the kitchen re-planning competition for members, for which 318 entries were received. The E.A.W. evidence was included in the report of the Beaver Committee on Air Pollution, and the Association accepted the invitation to give evidence to the Herbert Committee conducting an independent inquiry into the working of the electricity supply industry. During the year there were 143 successful candidates for the electrical housecraft certificates for demonstrators and saleswomen, making a total of 2,213. In the teachers' examinations 107 were successful, bringing the total to 149. The E.A.W. Diploma was awarded to 15 demonstrators and two teachers, making the respective totals 477 and 93.

Special attention was given by the Housecraft Department to scientific management in the home and the teaching of housecraft. Much work had been done in connection with a scientific management investigation into the services of the kitchen, and at the request of the Ministry of Education an active part was taken in a Ministry course for teachers. Other students visited headquarters.

Acknowledgment was made of the way in which Dame Caroline Haslett's outstanding branch engagements had been carried out by the chairman, Miss N. Balls, and by other members.

During the meeting voting took place for the six vacancies on the National Executive Committee, and the following were elected:—Councillor Mrs. L. Bell, Mrs. W. S. Carty, Mrs. C. U. Cole, L.L.A.(Hons.), Mrs. H. C. Gregory, O.B.E., J.P., Mrs. A. B. Lewis, J.P., and Mrs. G. A. Tatchell, J.P.

Association's Contribution to Development

At the conclusion of the meeting the annual luncheon was held, the guests including leaders from all branches of the electrical industry. The Dowager Lady Swaythling again presided.

The toast "Thirty Years—the Contribution of the E.A.W. to Electrical Progress" was proposed by Lord Citrine who paid his personal tribute to Dame Caroline Haslett. He spoke of the transformation which had taken place in the social and domestic life since the Association was formed, and said that domestic consumers now used thirty times as much electricity as when the E.A.W. was founded. The C.E.A. had surmounted the difficulties which faced it when it was formed and it had just passed a severe winter without power cuts, largely due to the construction of fifty large power stations in the last seven years. The Authority was now supplying something like 3¼ million more people than were using electricity seven years ago and at least 5,000,000 more were receiving services against pre-war days. Last year 14,000 farms were connected, as compared with 4,000 in pre-war peak years. Prices to the public had been kept below those of most other industries. In paying tribute to the Association, he said that the emancipation of women would have been slowed down but for its work.

After Lady Swaythling had responded, the toast of "The Contribution of Electricity to Progress" was proposed by Mrs. J. L. Stocks (former principal of Westfield College, University of London). She spoke of the industrial revolution brought

Left: Lord Citrine speaking at the annual luncheon; on his left are the Dowager Lady Swaythling and Sir Vincent de Ferranti. Right: The Dowager Lady Swaythling responds. In the foreground is Miss V. Norvick, assistant secretary

about by the development of steam and transport. One aspect had been the disappearance of household crafts and the domination of the specialist. With the development of electricity in the home there was something in the nature of a domestic counter-revolution and modern electrical appliances enabled many of these things to be done again in the home.

Sir Vincent de Ferranti, who responded, referred to Sir Lawrence Bragg's lecture at the previous evening's soirée and said that after scientists had made their discoveries engineers came in to design apparatus and equipment; he spoke of the engineer's achievements since the Deptford power station had been designed by his own father. It was useless for the engineer to employ the knowledge of the scientist, however, if his designs were not used. Ignorant people were afraid to use new things and that was where the E.A.W. played its part by taking these discoveries to the home.

Simplified Distance Protection Relay

DISTANCE relays may use impedance, reactance, admittance or conductance as a basis of distance measurement, depending upon the voltage, the length of overhead line or underground cable, and the resistivity of the ground. Complete three step distance protection requires theoretically eighteen ohmic measuring units to cover all kinds of faults. Some manufacturers use a single ohmic measuring unit that requires a switching arrangement, but such schemes tend to increase inconsistencies in operation and the clearance time.

The English Electric Co. has introduced a simplified system of distance relaying giving full protection and employing up to six types of standard relay unit in one of five simple arrangements. In this system, two types of ohmic measuring unit cover all distance relaying applications, the first being a directional impedance " mho " relay, used for most underground cables and for overhead lines over 35 (kV/I) miles in length (where I is the minimum fault current); and the second a reactance relay used for shorter overhead lines and for earth fault protection on overhead lines where the ground resistance is high. This suggests three arrangements using " mho " relays for all faults, reactance relays for all faults, or " mho " relays for phase faults and reactance relays for ground faults.

English Electric directional impedance relay type YCG

Two more schemes are available for solidly-earthed systems in which economy is important and high-speed clearance of earth faults is not essential, namely, using " mho " relays for phase faults and inverse-time relays for earth faults, or reactance relays for phase faults and inverse-time relays for earth faults.

These five systems can be made up using the " building block " approach employing the two ohmic measuring relays, a timing relay, a phase-fault detector, an earth-fault detector, and a directional inverse-time relay for earth faults.

The use of the same standard units for the five distance schemes facilitates stocking of spare relays and permits changes to be made. For instance, if a tap line or a new substation is added on a transmission line a short distance from an existing station, the " mho " relays at the existing station may have to be changed to reactance relays, but the remaining relays and their connections are unchanged. Furthermore, a station may start with inverse-time, earth-fault relays, and increased system capacity may make it advisable to change to distance protection for earth faults; here again the change would be fairly simple with these standardized units.

Details of the six standard relays used in these schemes are as follows:—The directional impedance " mho " relay is an accurate, induction cup type admittance relay with a wide (60/1 ratio) ohmic range and a minimum operating time of less than one cycle. It has strong directional action for faults close to the bus even with zero voltage. It is in effect a single unit with combined directional impedance characteristics that fit around the fault area, making it immune to any conditions other than a fault within its setting. For instance, it will not operate on any power swing from which the power system can recover. The phase angle of the characteristic is adjustable to suit the line so that the effect of arc resistance is minimized. The reactance relay is a similar relay except that it is current polarized instead of potential polarized. It has the same accuracy ($\pm$ 2 per cent of setting over a wide range of current) and the same speed of operation but is non-directional and therefore includes a directional unit similar to the " mho " relay. The resetting current of both these relays is only 1 per cent less than the operating value and their distance reach is essentially the same for any fault conditions regardless of offset current waves and other transient conditions.

The other relays are a timing unit, operated by a powerful electrically wound spring, damped by a strong magnet acting on a copper cup; a phase fault detector, which is an induction cup type " mho " unit similar to the " mho " relay used for distance measurement but less accurate and without the refinements for preventing over-reach on transient conditions; an earth-fault detector, containing a residual current unit, blocking relay for distinguishing between single and double earth faults, and a tapped auto-current transformer for residual current compensation and parallel line mutual compensation; and an earth-fault relay of the directional inverse-time type with an instantaneous unit, applicable to most solidly-earthed systems instead of another set of distance relays, for single-phase earth faults.

INDUSTRIAL NEWS

London Design Centre

The Council of Industrial Design announces that the premises have been acquired for a Design Centre for British Industries at 28, Haymarket, London, S.W.1. Arrangements are being made to open the Centre as a permanent but changing exhibition early in 1956. The Centre will show a wide range of products which will attract home and overseas buyers as well as the Press and the general public. The exhibits will mainly be durable consumer goods at various price levels, such as textiles, furniture, carpets, pottery, glass, cutlery, kitchen equipment, hardware, travel and sports goods, office machinery, lighting and heating appliances, outdoor furniture, garden tools, etc.

Irish Telephone Contract

Against keen foreign competition, which included American, Dutch and German companies, the Automatic Telephone & Electric Co., Ltd., recently obtained an order valued at over £20,000 to supply the Irish Department of Post and Telegraphs with three twelve-channel open-wire telephone carrier systems. The new carrier equipment, which will link the tourist centres of Limerick and Tralee, and Limerick and Ennis in the south-west, and Mullingar and Cavan, in the north, is designed to ease congestion on internal circuits and reduce delays on trunk routes. The equipment was delivered within thirty-five days of the order being placed and is expected to be in service by the middle of June—in time to deal with peak tourist traffic.

Television in Jersey

Mr. W. K. Allen, managing director of the Jersey Electricity Co., Ltd., has handed us a photograph (reproduced above) of the new television receiver showroom which has just been opened at the company's St. Helier headquarters. Television service is being supplied in Jersey by Rediffusion, Ltd. The B.B.C. transmission from North Hessary Tor is picked up and relayed over the Electricity Company's lines.

The Jersey Electricity Company's new television showrooms

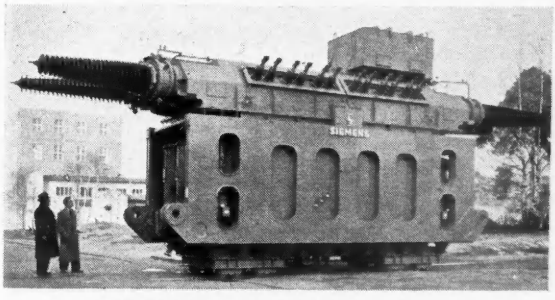
The new showroom has a floor area of about 3,000 sq ft and about half a dozen different makes of receivers are supplied on two-year terms; the company operates a servicing organization.

Aluminium Imports

The Board of Trade announces that from 6th May separate licences will no longer be needed for the import from any source of unwrought aluminium, unwrought aluminium alloys, and aluminium scrap. Details are given in Notice to Importers No. 729, dated 29th April.

World's Largest Transformer

The accompanying illustration is of what is claimed to be the world's largest transformer. This transportable equipment with built-in cooling radiators was constructed for the Rheinische-Westfalische Elektrizitatswerke by Siemens-Schuckertwerke A.G. at their transformer works in Nuremburg. It is rated at 200,000 kVA and has a voltage ratio of 10·5 kV : 245 kV. The transformer is nearly 50ft long and weighs 208 tons without its 30-ton oil filling. It was transported from the works to the power station in its completely assembled condition while suspended between two special nine-axle railway trucks.



200,000 kVA Siemens-Schuckert transformer

Import Licensing in Australia

The Minister for Customs (Senator O'Sullivan) reports that goods previously licensed on a "no quota restriction," including portable electric hand tools, air compressors, electrical insulating materials, electrical meters and graphite electrodes, will in future be licensed on the basis of 100 per cent of the imports for the year ended 31st December, 1954.

Mr. Latham Withall, Federal Director of the Associated Chambers of Manufactures, said recently that import licensing was "here to stay." He considered that a varying measure of trade control was necessary because Australia's population was growing more rapidly than its export capacity. There was no immediate prospect of Australia's increasing its overseas earnings substantially. The new import cuts would give an immediate impetus to many sections of Australian industry.

Insurance Against Cadmium Poisoning

Whether cadmium poisoning should be a "prescribed disease" under the National Insurance (Industrial Injuries) Acts, and if so, for what occupations, is being considered by the Industrial Diseases Sub-Committee of the Industrial Injuries Advisory Council. Industrial injuries benefit can already be claimed for acute cadmium poisoning as "injury by accident." The Committee is inquiring into the possibility that prolonged exposure to cadmium at work can give

rise to chronic ill-health against which insurance cover should be provided. Persons and organizations interested in this matter are invited to submit written evidence. Communications should be sent to the secretary, Industrial Injuries Advisory Council, 10, John Adam Street, London, W.C.2, by 6th June next.

Exhibition of Photography

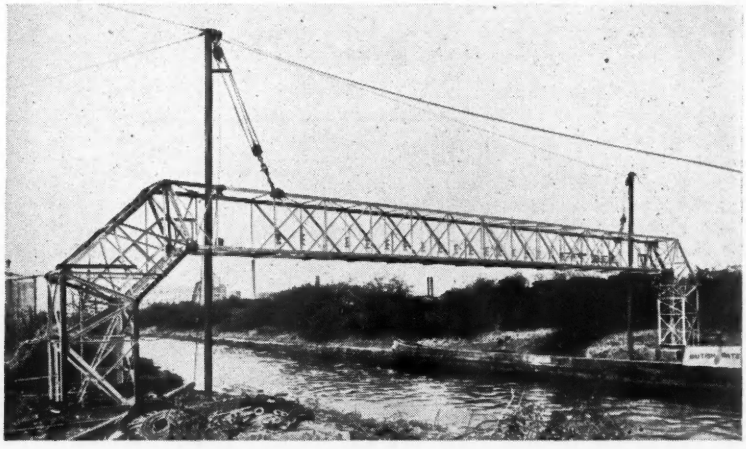
On Tuesday last the Minister of Works opened the Royal Photographic Society's Spring Exhibition of Architectural, Commercial and Industrial Photography. This is the first of the Spring Exhibitions organized by the Society since its Council decided last year to divide its annual exhibition into sections which would be organized in spring and autumn. The exhibition consists of prints, transparencies and stereoscopic items, in monochrome and colour, and altogether there are 260 examples from 80 photographers. It provides an interesting cross-section of outstanding photographic work in the reproduction of modern and ancient buildings, carving, furniture, factories, installations, equipment, tools, locomotives, and similar subjects. The Exhibition will remain open until 27th May.

Taxation and Earnings

Aims of Industry, Ltd. (12, Carteret Street, London, S.W.1), has produced a new edition of "The Earnings of Industry" (price 4s) which deals with the nature and function of capital in British industry. By quoting actual examples it shows the relative weights of material costs, wages and salaries, taxation, capital charges, etc. Stress is laid upon the harmful effects of excessive taxation and upon the small proportion of receipts absorbed by dividends.

Canal Cable Gantry

A cable gantry of 82ft span and weighing 4 tons was erected at Hayes, Middlesex, recently to carry 33 kV cables and accessories across the Grand Union Canal. The work was carried out by British Insulated Callender's Construction Co., Ltd., for the Southern Electricity Board as part of a contract for the supply of 33 kV oil-filled cables between North Hyde substation and Springfield Road, Hayes.



Cable gantry over the Grand Union Canal

The Inland Waterways Executive allowed two hours for the erection of the gantry and the traffic along the canal was interrupted only for that time. A few days before this, however, the stanchions and foundations had been completed. Difficulties of access necessitated the man-handling of all the materials which were brought to the site by barge. After erection was completed, the gantry was covered with corrugated steel and the cables were then run. The steelwork was fabricated by Painter Bros., Ltd.

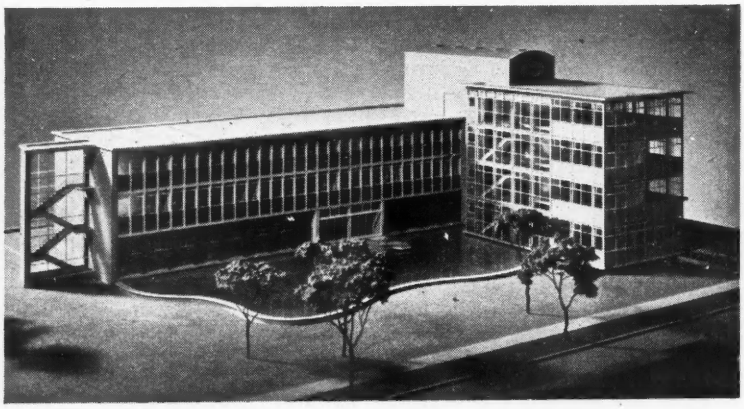
Colour T.V. Laboratory

A model of what is claimed to be the first building in this country planned specifically for the development of colour television, designed for Sylvania-Thorn Laboratories, Ltd., by G. A. Jellicoe, F.R.I.B.A., M.T.B.I., P.P.I.L.A., is being exhibited at the Summer Exhibition of the Royal Academy at Burlington House.

The building is divided into three distinct blocks. On the left is the laboratory section, a three storey structure, connected by a link block of five storeys, to the offices on the right, which have four floors. The top two floors of the laboratory section will be devoted to actual development work. Both upper floors are air conditioned, dust extraction being controlled to two parts in one million. In view of the situation of the site on a main trunk road all windows are double glazed and there is further provision for noise insulation with extra acoustic treatment to ceilings and walls.

All the operating machinery for heating and refrigeration, for dust extraction and air compression is accommodated on the ground floor which is isolated from the remainder of the building so that no vibration can be transmitted to the floors above. The entrance hall area in the office block passes completely through the full building height and contains the main staircase with the central column as a lighting feature inside which fluorescent lighting extends from floor to ceiling. Above the entire area a "lumenated" ceiling will provide diffused lighting. The general lighting throughout will be fluorescent with supplementary tungsten filament sources, fittings being staggered to give high level lighting over the entire working area. The model was constructed for the architect by McCutchon Studio.

A model of the new colour T.V. laboratory of Sylvania-Thorn Laboratories, Ltd.



Election Manifestos

The plans outlined in the election manifestos of the Conservative and Labour Parties contain little of direct electrical moment, although the industry is naturally concerned with the general aspects of the policies put forward by both parties. In "United for Peace and Progress" the Conservatives affirm their belief in the efficacy of free enterprise and the minimum of control. They claim that the Conservative Government was the first in the world to launch a programme of nuclear power stations on a commercial scale and promise that this will be "pressed ahead at the utmost speed."

They say that we must ensure by progressive conversion of electric power stations that their mounting fuel needs can be met by oil instead of coal. They also intend to make it possible for the British Transport Commission to push on with its comprehensive plan for the modernization and re-equipment of the railways.

"Forward with Labour," the Labour Party's election programme, promises a "real drive for better technical education." It is proposed to re-nationalize road transport and the steel industry and "bring sections of the chemical and machine tools industries into public ownership."

Northern Radio Show

The Northern Radio Show which opened at the City Hall, Manchester, on Tuesday last shows, for the first time, many new television sets which tune to both the B.B.C. and commercial I.T.A. programmes and a number of sound radio sets suitable for the reception of the new B.B.C. v.h.f. sound broadcasts. Almost all new T.V. sets, whether table or console models, this year include facilities for tuning to Band III frequencies for the I.T.A. broadcasts due to start in the autumn. A special cable network in the City Hall provides exhibitors with vision programmes on two channels, one in Band I and the other in Band III, so that sets can be demonstrated working on both B.B.C. and I.T.A. frequencies. On the B.B.C. Band I channel there is a continuous programme drawn from three sources—the B.B.C. studio in the exhibition, the current B.B.C. programme on the national network from Holme Moss (by landline to avoid the possibility of interference) and from a film scanner in the R.I.C. control room. The exhibition continues until 14th May.

Home Laundry Window Display

The accompanying picture shows a home laundry window display designed by the Yorkshire Electricity Board, which is to tour the No. 2 Sub-Area. It shows "Father" with a broken clothes line in the rain, and suggests that the solution to his dilemma is the English Electric tumbler dryer shown in the display.

E.T.U. Punishes Lyons' Electricians

Several more of J. Lyons & Co.'s electricians who broke the four-month-long strike last summer by returning to work against the orders of the Electrical Trades Union have been punished by the union. They have received letters from the executive council severely censuring them and suspending them from all cash benefits for the next five years. The remainder of the 140 men who took part in the return to work are expecting to receive similar letters. Four electricians have already been fined and suspended from benefit. Two of them have been expelled from the union for non-payment of the fines and the other two have announced their intention not to pay their fines.

Expanded Metal Exhibition

To display the industrial, commercial and domestic uses of its products, the Expanded Metal Co., Ltd., has just held a successful exhibition at the Exchange Engineering Centre, Birmingham. On view were examples of its application for reinforcement and building work of all kinds, electrical resistors, grilles, walkways, barriers and many other uses. Several hundred visitors from Birmingham and other Midland centres toured the display during the three days it was open. A similar exhibition is to be held by the company at the C.W. Bouchier Hall, 20, Newport Road, Cardiff, from 24th to 26th May.

Wholesalers' New Showroom

A new showroom was opened on 25th April by H. E. Kettle, Ltd., Knightrider Street, Maidstone. The opening was attended by 140 customers and wives who saw demonstrations of washing machines, food mixers, and dryers. In attendance also was the Avo demonstration van. The showroom, which has been considerably enlarged, shows a selection of electrical, radio and cycle supplies. The visitors were also conducted over the stores which occupy some 9,000 sq ft. The showroom is also used to illustrate the effects of louvred open top fluorescent fittings supplied by Ekco Ensign and is heated by a selection of different types of oil filled radiators by Dimplex.

Electrical Commercial Travellers

A supper and general meeting of the Electrical Trades' Commercial Travellers' Association will be held on 13th May (6 for 6.30 p.m.) at the Feathers Hotel, Broadway, Westminster, London, S.W.1.

The Manchester Branch of the Association is holding a general meeting on 9th May (7 p.m.) at "The Swan with Two Necks," Withy Grove, Manchester.

Advertising Association Conference

The 22nd annual conference of the Advertising Association opens to-day (Friday) at the Dome, Brighton, and will continue until Sunday.

Trade Announcements

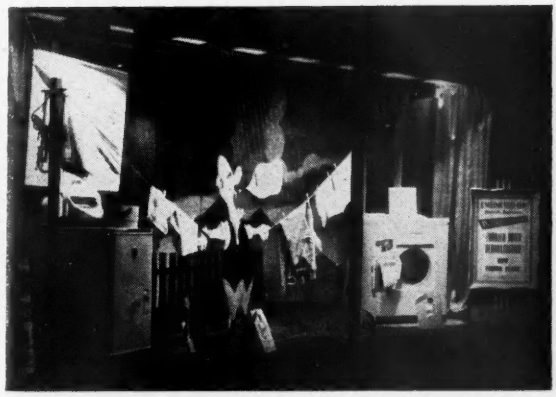
The address of **Electric Repairs (Nottm.), Ltd.**, is now Noel Works, Elson Street, New Basford, Nottingham.

J. & N. Wade (London), Ltd., announce that their new depot at 13a, St. George's Street, Norwich, Norfolk (telephone: 26584), was opened on 4th May. The depot is under the management of Mr. R. Pudney.

Due to building alterations, the postal address of the Leeds branch of **Sangamo Weston, Ltd.**, is now 49a, The Headrow, Leeds, 1.

Monks & Crane, Ltd., have opened a branch office at 23, Dean Street, Newcastle-upon-Tyne. Mr. John Coe is responsible for both stock control and office organization with Mr. K. Keighley as the area representative.

The Nottingham office of **Burton, Griffiths & Co., Ltd.**, is now at 18, Carrington Street, Nottingham (telephone: Nottingham 53201).



A home laundry display which is touring the No. 2 Sub-Area of the Yorkshire Electricity Board. Right: The new showroom of H. E. Kettle, Ltd., Maidstone

Morden Milk Centre

Extensive Washing and Bottling Plant

RECENTLY we had the opportunity of visiting the South Morden plant of the Express Dairy Co., officially opened on 21st April by the Rt. Hon. D. Heathcoat Amory, M.P., Minister of Agriculture and Food. The new centre serves the south-west quadrant of the Greater London area and supplies fifty of the company's retail distributing branches. It is claimed to be the first dairy in the world to be completely equipped with mechanical handling devices which ensure that milk bottles are untouched by hand from the time they are collected empty from the doorstep until they are returned there, washed, filled, capped and sealed.

Because of this high degree of mechanization the total staff is only just over 200. The plant, which covers three acres is capable of handling up to 1,100,000 bottles of milk (120,000 gal) a day, and was erected at a cost of £700,000. The electricity consumption is in the region of 30,000 kWh weekly, and a million gallons of water is used each week for washing purposes.

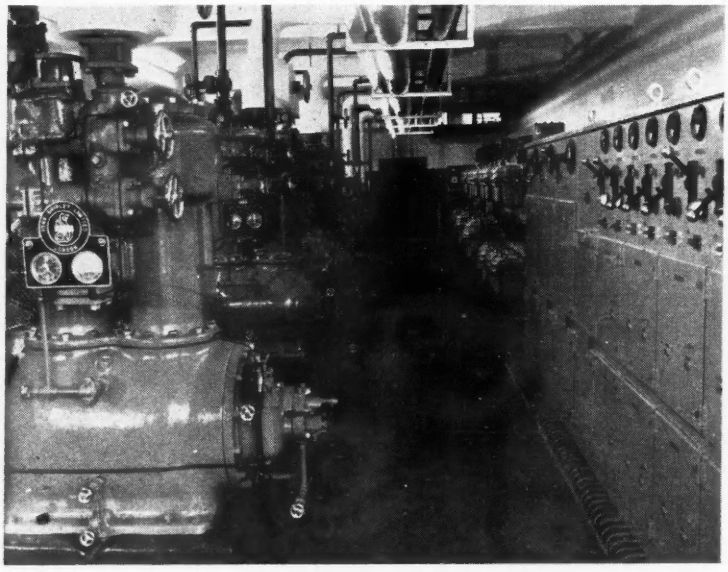
Raw milk is delivered by road and rail tankers and discharge is by mechanical pumps through stainless steel and glass pipes. After sampling and testing the milk is pumped to the processing floor where there are fourteen 3,000 gal stainless steel tanks for raw and finished milk, both of ordinary grade and tuberculin tested. Pasteurization is carried out in four stainless steel plate-type heat-exchange units with a total capacity of 8,000 gal an hour. The tremendous task of washing and sterilizing such a large number of bottles every day has been dealt with by installing five specially designed bottle washers each with a capacity of over 10,000 bottles an hour. Each bottle is subjected to a concentrated cleansing by powerful jets and passes through one pre-rinse, two hot detergent and two rinse sections, followed by a final rinse in mains water. Temperatures are automatically controlled throughout.

The crates of empty bottles are unloaded by machines which automatically transfer the bottles to a conveyor. From this conveyor the bottles travel to the accumulator which in turn automatically feeds the washing machine. After discharge from the washing machine the bottles are scrutinized for any possible fault and then travel to the filling and capping units. Ten stainless steel integrated units are used with a total capacity of 45,000 bottles an hour, and up to 120,000 gal of milk daily. Each bottle is fed to a vacuum head for filling, after which it is transferred to a machine which cuts, stamps, and preforms the aluminium foil cap, fits it to the mouth of the bottle and grip seals it in place.

The operator's flush-mounted control panel, consisting of two hose-proof push buttons and pilot lamps, the stop button incorporating a safety device to prevent the inadvertent starting of the machine, is conveniently situated near the discharge end of the filling machine. In all there are ten such machines.

Because of the risk of exhaust fumes both the unloading and loading of crates are carried out by electrically driven "Conveyancer" battery-electric fork-lift trucks. For refrigeration purposes, five York Shipley compressors (three of which are driven by 100 h.p. motors) are contained in the refrigeration room. This room also contains the switchgear control motors, and the whole of the temperature control is automatic. Steam for pasteurizing, heating and bottle sterilization is raised in two solid fuel fired, horizontal boilers which are fed automatically by mechanical stokers. The "Permutit" fully automatic water softening plant is designed to provide a total flow of 15,000 gal of softened water an hour for bottle washing purposes, and the capacity of each of the two softeners between regenerations is 103,000 gal.

Amenities include a well-equipped staff canteen and there is a demonstration kitchen and lecture room which is in daily use both for experimental and demonstration purposes.



The interior of the refrigeration room at the Morden milk-handling plant

Sales Development

Boards' Commercial Activities Discussed

THE four-day annual conference of the British Electrical Development Association (the papers presented at which were summarized in our last issue) concluded on Friday with a general discussion followed by a luncheon at the Connaught Rooms, London. During its course the conference was attended by over 800 people and was agreed to be one of the most successful of the series.

The meeting on the final day was presided over by Mr. V. W. Dale, director and secretary of the E.D.A., who emphasized the importance of " selling," an aspect which had not so far received very great attention at the British Electrical Power Convention. There had been a lot of talk of gas at the conference, and rightly so. If the chairman of the Gas Council were there he might well ask them what they had to worry about, in view of the rate at which electricity supply was expanding. " In spite of this, and paradoxical as it may sound, we are farther removed from saturation to-day than on the first day that E.D.A. started," Mr. Dale said. He believed that for certain important purposes gas was on its way out. Long before the end of the century he could conceive that the whole pattern of their life would be changed and for this reason he was greatly disappointed with the White Paper on nuclear power, convinced as he was that things were going ahead much faster than it indicated; that electrical development in the second half of the century would completely eclipse that achieved during the latter part of the first half.

Opening the discussion, Mr. W. R. Rowe (South Western Board) spoke appreciatively of the papers presented and Mr. H. G. Gamble (Eastern Board) thought that both these and the discussions had been most valuable. So that the work of the conference should not be allowed to fade out he would like to have recommendations from the conference referred to the liaison officers' panel and the E.D.A. staff for discussion. He particularly commended the views expressed by Mr. N. H. Bridge on the need to take the fullest advantage of the presence of people who went to the service centres.

A suggestion was made by Mr. R. E. Gamlen (South Eastern Electricity Board) that the present four-day conference with six papers was perhaps too much for adequate concentration, but the delegates voted overwhelmingly in favour of the retention of the full programme. Mr. U. F. Murray (South of Scotland Board) applauded the introduction of guest speakers and thought that they might extend this idea and invite several consumers to come along and speak on the subject of " What we expect from the Electricity Boards." Mr. A. E. Mulvaney (South Western Board) thought that as an incentive the Area Boards might consider the idea of sending to the conference a number of their best salesmen. Mr. G. L. Tomlinson (Yorkshire Board) put forward the idea of discussion groups under the chairmanship of the chief commercial officers who could then present summaries of what had been said to the conference.

When the delegates considered advertising methods and media, it was questioned whether electrical publicity had sufficient " punch " and selling appeal in view of the rate at which the gas industry was installing water heaters and cookers. Miss Taylor (Eastern Electricity Board) remarked that the gas industry was particularly progressive in its methods of recruitment of home service advisers. They were in constant touch with the colleges where the girls were trained. These girls were taken straight into the industry on a professional basis at a salary in the region of £400 a year and were given 14 weeks' training. In the electrical industry girls were taken on at £3 10s to £4 a week and were lucky if they received any training. Generally they had not much chance of rising above Grade 1. It was perhaps not entirely a coincidence that in the Eastern area, where they did have an opportunity of getting above Grade 2, the Board had a selling record in electrical appliances second to none.

Opening of the E.D.A. Conference at the Caxton Hall. Left to right: Mr. S. W. Hazell, Sir John Hacking, Mr. S. F. Steward, Mr. V. W. Dale and Mr. J. A. Stedman (education officer, E.D.A.)

Miss Gilbert answered questions on television publicity. She said it was disappointing to find, after publicity had been built up in a particular new appliance, people who went to the service centres were told " We have never heard of it." She mentioned in particular the heat pump.

Mr. Dale thought that what the electrical industry lacked was a good slogan and a symbol. So far their efforts in this direction had not met with success.

Mr. B. E. Youngs (Eastern Board) referred to the numerous hire purchase and credit sale agreements and said it would be a great advantage if they had one universal agreement.

One delegate spoke of the assistance a member of his staff had received from the Electrical Industries Benevolent Association and asked whether the general secretary could be invited to tell them something of the work that the Association was doing.

At the luncheon which followed Mr. S. F. Steward, chairman of the E.D.A. Council and of the South Western Electricity Board, who presided, said he believed that the conference was the largest so far and thanked all those who had helped to make it such a success, in particular their president, Sir John Hacking, the authors of the papers and Mr. Dale and the staff of the Association. He was sure they must all be encouraged by the new atmosphere of development and expansion that pervaded the industry. They had a tremendous opportunity to promote a great surge forward in the next few years.

Sir John Hacking also emphasized the importance of the commercial effort of selling electricity and of persuading people to use it on an ever-increasing scale.

Domestic Electrical Equipment

Dry Shavers

APART from the convenience of being able to shave wherever an electricity supply is available, the dry shaver has several advantages which commend it to the user, the chief of which is the fact that one can dispense with the need for soap, hot water, etc., and the absence of the risk of cuts.

In all there are now nearly a dozen different models on the market and several manufacturers include more than one model in their range. In addition to their higher operating efficiency, several developments have taken place both in comfort of holding and, to some extent in consequence, in appearance. Most types are suitable for use on a.c. and d.c. supplies and cover a voltage range from 100 to 250 V. Battery types for either 6 or 12 V are also available for car owners. Among models introduced since our last survey is a popular American model, now being manufactured in this country, which is claimed to have 24 million cutting actions per minute.

Generally speaking, prices of dry shavers, including purchase tax, range from as little as £4 for single head models, incorporating a vibratory movement, to £10 and over for multi-head types having impulse rotary motors, "suppressed" for radio and television interference, and provided with resistance adaptors, etc.

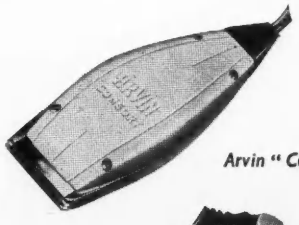
Manufacturer	Name or Model	Type	Weight	Voltage Range	Special Features	Finish	Price (excl. tax)	Purchase Tax
ARVIN ELECTRIC CO., LTD., Fernbrook Avenue, Southend-on-Sea.	"Consort"	Twin-head	11 oz (lead attached less pack)	200/250 a.c. or 100/125 a.c.	Vibrator movement. Built-in hair trap. Instantly detachable head	Cream plastic moulded body	£3 4 0	£0 11 0
	"33"	Triple head	12½ oz (less lead and pack)	Any two of 200/250, 100/125 or 12 V a.c./d.c.	Impulse motor. Self-cleaning inner shears. Stainless steel outer shears. Suppressed	Ivory and grey moulded body	£7 11 0	£1 8 9
BRAUN (BLETCHLEY), LTD., Balham Road, London, N.9.	"S.50"	Single head	7 oz	100/125 a.c. or 200/250 a.c.	Vibrator driven cutter. Dual voltage	Cream	£5 6 8	£1 0 0
CHILTON ELECTRIC PRODUCTS, LTD., Hungerford, Berks.	"Buk"	Five-in-one head	14 oz	210/250 a.c. or 100/120 a.c.	Vibrator movement. On-off switch. Machine ground hardened steel head	Ivory urea casing	£4 15 0	£0 18 7
	"Kub"	Five-in-one head	12 oz	210/250 a.c. or 100/120 a.c.	Vibrator movement. Machine ground hardened steel head	Two-colour "Diakon" casing	£3 7 7	£0 12 4
	"Kub" Dual-volt	Five-in-one head	12 oz	110/250 a.c.	Vibrator movement. Machine ground hardened steel head	Two-colour "Diakon" casing	£4 0 4	£0 14 8
JOHN A. FRANSEN, LTD., Northwood Mills, Middlesex.	"Rabaldo"	Twin-blade "Dual-Ras"	8¼ oz	200/250 a.c./d.c.	Actual shaving blade operates directly in contact with the skin	Cream plastic case	£6 13 0	£1 6 9
	"Rabaldo"	Four-blade "Multi-Ras 1"	10 oz	200/250 a.c./d.c.	Actual shaving blade operates directly in contact with the skin	Cream plastic case	£8 15 0	£1 15 10
	"Rabaldo"	Four-blade "Multi-Ras 2"	10½ oz	100/250 a.c./d.c.	Actual shaving blade operates directly in contact with the skin	Cream plastic case	£9 15 0	£1 19 7

Chilton "Buk" shaver

Chilton "Kub" shaver

Philips "Philishave" mains model

Braun "S.50" dual-volt model



Arvin "Consort"

Arvin "33" model in case

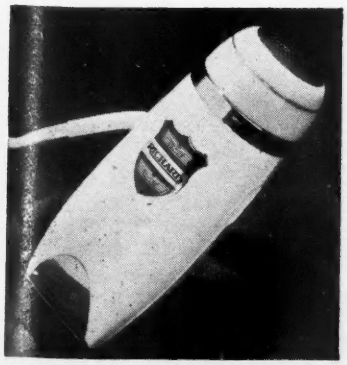
Manufacturer	Name or Model	Type	Weight	Voltage Range	Special Features	Finish	Price (excl. tax)	Purchase Tax
PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2.	"Philishave" 7743	Two rotary head	8¼ oz	110/130 and 200/250 a.c./d.c. 120 V from dry battery	Rotary action	Ivory and chromium	£6 4 11	£1 4 4
	"Phliishave" 7749/09	Two rotary head	8¼ oz	Three 1½ V flashlamp batteries or 6 and 12 V car battery with special adaptors	Rotary action	Maroon and chromium	£8 3 1	£1 14 11
PIFCO, LTD., 36-37, Upper Thames Street, London, E.C.4.	"Pifco" 1126	Foil sieve cutting head	10 oz	200/250 a.c. or 100/110 a.c.	Snap-action side cover for easier cleaning	Cream plastic and ivory plastic container	£3 7 3	£0 12 3
REMINGTON RAND, LTD., Commonwealth House, 1-19, New Oxford Street, London, W.C.1.	"60" Regular 451–210	Multi-head	10½ oz	210/250 a.c./d.c.	Extra-long shaving heads. Powerful motor. Hygienic cleaning	Cream plastic body. Mottled fawn hairtrap	£8 6 0	£1 11 11
	"60" Dual-volt 451–50	Multi-head	10½ oz	110/150 and 190/250 a.c./d.c.	Extra-long shaving heads. Powerful motor. Hygienic cleaning. Dual voltage	Cream plastic body. Mottled fawn hairtrap	£9 3 0	£1 14 11
	"New Contour" Regular 652–210	Three double "Blue Streak" shaving heads	10½ oz	210/240 a.c./d.c.	Powerful motor. Hygienic cleaning	Cream plastic body. Mottled fawn hairtrap	£6 3 0	£1 2 0
	"New Contour" Dual-volt 652–50	Three double "Blue Streak" shaving heads	10½ oz	110/150 and 190/240 a.c./d.c.	Powerful motor. Hygienic cleaning. Dual voltage	Cream plastic body. Mottled fawn hairtrap	£6 13 6	£1 3 10
B. H. RIES, LTD., 19-21, Hatton Garden, London, E.C.1.	"Richard" R.S	Dual head	12 oz	110/120 or 200/250 a.c./d.c.	Rotary shaving head and clipper head	Highly polished "Plexiglas" body	£7 12 11	£1 6 1
	"Richard" Standard	Dual head	12 oz	200/250 a.c./d.c.	Rotary shaving head and clipper head	Highly polished "Plexiglas" body	£7 12 11	£1 6 1
	"Richard" Car-Model	Dual head	12 oz	6/12 battery	Rotary shaving head and clipper head	Highly polished "Plexiglas" body	£7 18 9	£1 8 9
ROLLS RAZOR, LTD., Cricklewood Broadway, London, N.W.2.	"Viceroy" A.C.	Single-head twin cutter	10½ oz	200/250 a.c.	Self-starting. Vibrator movement. Lamp adaptor supplied	Maroon plastic body	£4 10 0	£0 16 6
	"Viceroy" Universal	Single-head twin cutter	9½ oz	90/250 a.c./d.c.	Voltage change switch. Lamp adaptor supplied	Ivory plastic body	£5 13 0	£1 0 8
	"Viceroy" Twin-Four	Multi-head	11½ oz	90/250 a.c./d.c.	On/off and voltage change switches. Lamp adaptor supplied	Ivory plastic body	£7 7 0	£1 9 4
	"Viceroy" V-Ten	Angled multi-head	12 oz	90/250 a.c./d.c.	On/off and voltage change switches. Lamp adaptor supplied	Ivory plastic body. Coffee dust cover	£8 5 0	£1 12 8

Fransen "Rabaldo" Multi-Ras shaver

Pifco vibrator shaver

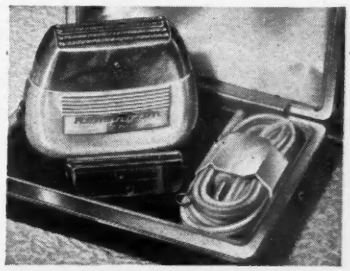
Rolls "Viceroy" A.C. model

Rolls "Viceroy" Twin-Four



"Richard" dual-head shaver (B. H. Ries)

Remington "New Contour"



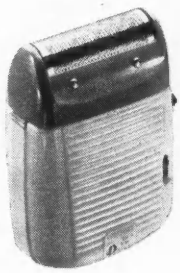
Remington "60"

Manufacturer	Name or Model	Type	Weight	Voltage Range	Special Features	Finish	Price (excl. tax)	Purchase Tax
RONSON PRODUCTS, LTD., 352-353, Strand, London, W.C.2.	"Ronson"	Micro-thin head	8½ oz	100/125 a.c. or 200/250 a.c.	Twin-coil power unit. On/off switch. Transparent guard	Cream and beige moulded body	£7 9 5	£1 8 1
SUNBEAM ELECTRIC, LTD., 14-16, Old Quebec Street, London, W.1.	"Shavemaster" W-RA Dual-volt	Micro-thin head	1 lb 13 oz (including packing)	100/140 190/250 a.c./d.c.	16-bar armature motor. Nylon crankshaft. Self-sharpening	Cream moulded body. Chromium plated head	£9 12 8	£1 18 4
	"Shavemaster" W-ZA	Micro-thin head	1 lb 5 oz (including packing)	210/250 a.c./d.c.	16-bar armature motor. Nylon crankshaft. Self-sharpening	Cream moulded body. Chromium plated head	£8 15 9	£1 14 3

Sunbeam "Shavemaster" W-ZA and pouch

Sunbeam "Shavemaster" W-RA shaver shown with resistance adaptor

Ronson shaver



Pharmaceutical Factory Lighting

AN unusual fluorescent lighting installation which will eventually consist of about 3,000 fluorescent fittings is being installed in Smith & Nephew's new factory at Neptune Street, Hull, where "Elastoplast" and pharmaceutical and surgical products are made.

The products of the factory must be made under the most hygienic conditions and this has had an important influence on the design of the building. There is a central service duct to each floor which is capable of accommodating all services such as lighting, heating, ventilation, power, water and other supplies.

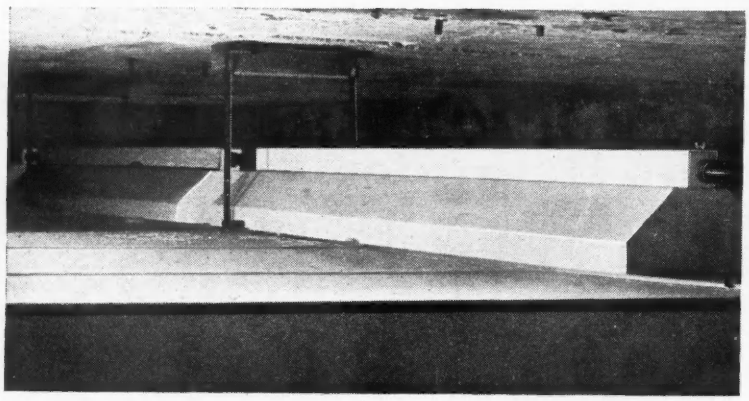
To produce a clean working area false suspended ceilings are incorporated throughout the works area and dustproof fluorescent lighting fittings mounted flush to the suspended ceilings have been used.

This required the specially designed and manufactured vitreous enamelled reflectors to be housed in the aluminium extrusions which formed the runners for the suspension of the ceiling board. Single 80 W fluorescent lamps were chosen as being the most efficient and economical to produce the desired level of 20 lumens/sq ft throughout the factory area, and six such fittings are used in each 20ft square bay, in two rows of three.

The control gear for each row of reflectors is mounted in a single box in the service duct. Wiring for lampholder leads was taken from these panels by 1in conduit through each line of reflectors, each unit being provided with three individual leads with a common neutral for each row of three. Switching was arranged to operate reflectors in pairs, working parallel with the windows, so that inner rows of units could be switched independently to make up the centre illumination on dull days, or in advance of the outer rows as daylight faded.

Lamps are replaced by removing the glazing of the reflector from below, a simple operation. Auxiliary gear is accessible from the service duct and by a system of lettering and numbering of the bays it is simple to correlate the respective control gear panels with their associated reflectors and lamps.

T. J. Smith & Nephew, Ltd., were responsible for the planning of the lighting, the contract for which was placed through T. Beadle & Co., Ltd., Hull, under the direction of Messrs. Atkins and Partners, consulting engineers and architects. The Merchant Trading Co., Ltd., supplied and erected the suspended ceilings.



Specially designed fluorescent fittings were mounted above the suspended ceilings

GENERATION AND DEVELOPMENT

The Zvornik (Yugoslavia) water power scheme now under construction

Electricity in the Peak District

As part of a scheme which is making electricity available to sixteen farms, a church and a school in the remote moorland area between Macclesfield and Buxton, a supply was switched on last Friday at the "Cat and Fiddle" inn. This well-known hostelry stands at a height of 1,690ft above sea level in an exposed and isolated position on the main road between Buxton and Macclesfield, and is often completely cut off from contact with the outside world during winter snows. Electricity will therefore bring a welcome added amenity.

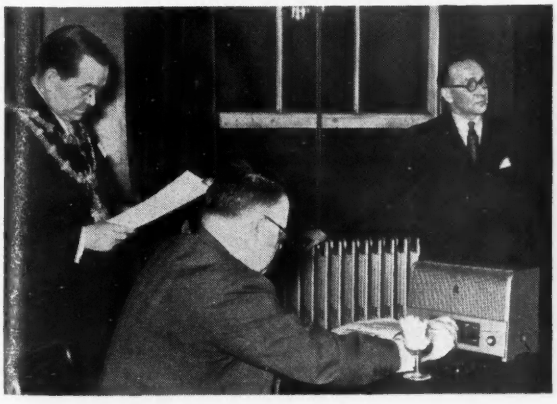
The North Western Electricity Board's scheme, including connection of the inn, has involved the erection of 4½ miles of overhead line, and the work has taken about two months. Great care has been taken in preserving amenities and the layout was agreed between the Board and the Peak Park Planning Board. The line to "The Cat" emerges from the Wildboarclough valley, approaches the inn from a concealing fold in the hills, and ends about a hundred yards away from it. From here, connection is made by underground line which crosses the road.

Lancashire Rural Extensions

The North Western Electricity Board's short-wave radio-telephone system was used when rural extensions were recently commissioned at Bury and Irlam. To inaugurate an extension feeding the Walmersley/Birtle area, the Mayor of Bury (Ald. J. E. Blakemore) passed a radio message over the Board's short-wave system to a radio van standing by outside the new Nangreaves substation and Mr. W. Collier, of the Bury District staff, then switched on. More than 20 farms, together with several houses and cottages, a school and two golf clubs in a semi-moorland area were supplied with electricity for the first time.

The Irlam switch-on was concerned with Chat Moss, a former bog which, since the end of last century, has been transformed into rich farm land by refuse tipping. Here Councillor J. McLean, chairman of Irlam Urban District Council, was given official authority by radio from Manchester Central Control before switching on the supply at the Beech Avenue substation. On the 2,000-acre Chat Moss, 19 farms and a cottage were given a supply.

The Mayor of Bury (Ald. J. E. Blakemore) inaugurates the new Walmersley/Birtle rural extension. On the right is Mr. E. G. Wardle, manager of the Board's No. 2 Sub-Area



Loch Glashan Project

The waters of Loch Glashan, Argyll, are to be harnessed under a scheme prepared by the North of Scotland Hydro-Electric Board and confirmed by the Secretary of State for Scotland. The scheme, which will produce about 17·6 million kWh annually, is required to help to meet the rapidly growing demand for electricity in the Kintyre and Knapdale areas. The loch lies in the hills behind Lochgair on Loch Fyne. The natural catchment area of Loch Glashan is 4 square miles and, by means of diversion aqueducts, use will be made of the rainfall on a further 20½ square miles including part of the catchment of the River Add which flows into Loch Crinan. All the water will be collected behind a dam, 1,100ft long and 45ft high, to be built at the outlet of Loch Glashan. From the dam water will be led by a tunnel and pipeline 5,500ft long to a power station with an installed capacity of 4,200 kW situated on the shores of Loch Gair into which the water will be discharged. The scheme is estimated to cost £1,300,000.

Yugoslav Water Power

After a severe winter work was recently resumed on the hydro-electric scheme at Zvornik, Yugoslavia. Here the River Drina is being harnessed to supply power to Western Serbia, Eastern Bosnia, Belgrade and the area between the Yugoslav capital and the Hungarian border. This is one of the several projects from which Yugoslavia hopes to export electricity to Austria, Italy and Western Germany. A photograph showing the progress of construction is reproduced above.

Transfer of Undertakings

The Minister of Fuel and Power has made the Electricity (Metropolitan Undertakings) (Transfer) Order, 1955 (S.I. 1955 No. 597, H.M. Stationery Office, 2d), which transfers to the London Electricity Board certain electricity undertakings in Greenford, Holborn, Paddington and Westminster which are in the Board's area but which vested in the Southern Electricity Board under the Electricity Act, 1947.

Power Points in Council Houses

Shipley Housing Committee proposes to apply for permission to borrow £12,000 for the installation of additional power points in pre-war Council houses.

Financial Section

STOCKS and SHARES

IN addition to the depressing effects of a threatened railway strike which, mostly happily, did not materialize, Stock Exchange markets have been reflecting indecision before a General Election of which the result, it is generally agreed, is going to make a considerable difference to the subsequent value and prospects of most securities. Meanwhile, the flow of company dividends and annual results in respect of 1954 continues to provide the main points of interest in the industrial markets. The final dividend from I.C.I., bringing up the total from the equivalent of 7½ to 10 per cent, was one of the major events of the week. It may have fallen short of the most hopeful estimates, but there was no disputing the excellence of the earnings figures. Other dividend declarations, referred to in the following notes, received a rather mixed reception.

Price Movements

The further decline in the gilt-edged market left the British Electricity stocks near the lowest points of the year, and was held largely responsible for the dull appearance of many industrials. A.E.I. ordinary are now quoted ex-rights to the offer of new shares (one for four) at 40s; the new opened at a premium of 27s 6d and declined a little as sellers came in. A small reaction in I.C.I. shares was associated not so much with the annual results as with the inclusion of chemicals among the industries marked for nationalization in the Labour election manifesto. Ever Ready, although dealt in below the official quotation of 28s 9d, held most of the 4s 9d rise induced previously by the increase of the dividend and earnings. In overseas stocks, Brazilian Tractions were depressed to $14½ by the company's decision to pass the dividend as a result of currency exchange difficulties.

Babcock & Wilcox

The final dividend declared by Babcock & Wilcox makes 15 per cent for 1954. Taking into account the increase of capital through a one-for-two scrip issue, the total represents an improvement of 3 per cent on the previous payment. It again leaves a high proportion of the year's earnings to go back into the business, for although the group trading profit of £4·1 million is very much the same as before, the net surplus is substantially higher as a result of a reduced tax charge; in the absence of the excess profits levy this falls from £2·6 million to £2·2 million. The new rate of dividend appears to have threefold cover by the earnings available, and brings the yield on the shares, which were subsequently on the dull side at 74s 3d, to a few pence over 4 per cent. Part of the shares' attraction for investors is no doubt associated with

The Week's Price Changes

Company or Board	Nom. Value	Middle price 2nd May	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1955 Highest	1955 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	86½	−1	3	3	3 9 3	94¼	86
Brit. Elec. 1974/77	100	85½	−1	3	3	3 10 3	93⅞	85¼
Brit. Elec. 1976/79	100	90½	−1	3½	3½	3 17 3	98⅜	90½
Brit. Elec. 1974/79	100	101½	−1	4¼	4¼	4 3 9	109	100½
Overseas Electric Supply								
Calcutta Elec.	£1	22/-	−6d	6†	6†	5 9 0†	22/6	20/9
East African Power	£1	21/6		7	7	6 10 3	23/3	19/9
Nigerian Elec.	£1	23/6		10	10	8 10 3	27/-	22/6
Palestine Elec. "A"	£1	21/-		Nil	Nil	—	22/9	21/-
Perak Hydro-Elec.	£1	18/-		6	10	11 2 3	21/-	17/9
Equipment and Manufacturing								
Aberdare Cables	5/-	12/9	−3d	12½	17½	6 17 3	13/9	11/-
Aerialite	1/-	6/6	+6d	88⅓	88⅓	6 15 9*	6/7	5/3
Allen, W. H.	£1	79/6		15	20	5 0 8	81/6	78/6
Aron Elec. Ord.	£1	59/6		20	15	5 0 10	62/-	55/6
Assoc. Elec. Ord.	£1	66/3x.c.		—	14	—	—	—
Automatic Tel. & El.	£1	72/-		15	15	4 3 4	79/6	69/-
Babcock & Wilcox	£1	74/3	−2/-	12*	15	4 0 9	81/6	68/6
Baldwin, H. J.	2/-	4/9		20	20	8 8 6	5/4	4/4
Bakelite	10/-	28/9		12½	16	5 11 6	32/-	27/-
British Aluminium	£1	40/-	−1/3	10	12	6 0 0	43/9	35/3
B.I. Callender's	£1	47/6	+1/6	10	10	4 4 3	55/3	44/9
B.I. Callender's 6% Pref.	£1	25/-		6	6	4 16 0	26/6	24/-
British Thermostat	5/-	23/9		35	27½*	—	27/3	22/6
British Vac. Cleaner	5/-	16/-		25	30	9 7 6	17/9	14/3
Brook Motors	10/-	41/3		20	20*	—	42/9	39/9
Brush Ord.	5/-	8/6		6	10	5 17 9	9/6	7/7
Bulgin, A. F.	1/-	5/-	−3d	30	45	9 0 0	5/3	4/-
Burco	5/-	18/9		35	25*	6 13 3	23/-	18/9
Chloride El. Storage "A"	£1	70/-	+1/3	12½	17½	5 0 0	70/-	58/6
Clarke Chapman	£1	82/6		20	20*	4 17 0	84/-	68/9
Cole, E. K.	5/-	19/6	−1/-	25	27½	3 10 6*	24/6	18/3
Cossor, A. C.	5/-	9/-	−3d	10	10	5 11 1	11/3	8/9
Crabtree	10/-	30/9		17½	20	6 10 0	34/6	29/3
Crompton Parkinson Ord.	5/-	16/9		20	20	—	19/9	16/-
De La Rue	5/-	21/9	−6d	Nil	20	4 11 11	24/3	18/9
Decca	4/-	34/6		35	56¼*	—	45/6	31/-
Desoutter	5/-	27/9		20	25	4 10 1	28/-	25/6
Dewhurst	2/-	8/-		19	24	6 0 0	8/3	7/3
Dictograph Tel.	2/-	7/-		20	20	5 14 3	7/6	6/6
Dubilier Condenser	1/-	5/-		25	25	—	5/7	3/10
E.M.I.	10/-	28/9	−6d	8	10	—	37/-	25/3
Electrical Components	5/-	15/9		20	20	6 7 0	17/6	15/3
Elec. Construction	£1	33/9		15	15	4 9 0*	37/3	31/6
Enfield Cable Ord.	£1	20/-		Nil	Nil	Nil	25/3	20/-
English Electric	£1	63/9		10	12½	3 18 6	69/3	54/3
English Electric 3¾% Pref.	£1	15/6		3¾	3¾	4 16 9	16/9	14/9
Ericsson Tel.	5/-	38/-	+6d	25†	20†*	2 12 9	38/-	29/-
Ever Ready	5/-	28/9		40	35*	6 1 9	28/9	22/3
Falk Stadelmann	£1	46/3		15	15	6 9 9	50/6	43/9
G.E.C. Ord.	£1	56/3		11½	12½	4 9 0	61/9	51/3
G.E.C. 6½% Pref.	£1	27/-		6½	6½	4 16 3	28/4	23/6
General Cables	5/-	15/9		30	30	9 10 6	17/-	15/9
Greenwood & Batley	£1	55/-		17½	17½	6 7 3	57/-	54/6
Hackbridge Cable	5/-	17/9	+6d	20	20	5 12 8	17/9	14/-
Hackbridge & Hewittic	5/-	24/6		20	25	5 2 0	28/9	23/9
Hall Tel. Acc.	10/-	13/3	−6d	10	10	7 11 0	13/9	11/-
Heatrae	2/-	4/6		12½	12½	5 11 0	5/9	4/3
Henley's	10/-	18/6	−1/9	10½	10½	5 13 6	20/6	17/-
Holophane	5/-	17/6		20	25	7 2 9	19/9	16/-

* After scrip issue. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

the company's participation in atomic power station installations.

Dividends Declared

As in the case of Babcock & Wilcox, the Automatic Telephone & Electric Company reports very little alteration in the group trading profits of last year, but a considerable increase this time in the disposable surplus after tax deductions and adjustments. Dividends on the ordinary and deferred remain at 15 per cent for the fifth year in succession, but are payable now on capital increased by a one-for-ten scrip issue. The ordinary shares were little changed on balance at about 72s. The yield at this figure is £4 3s 4d per cent. W. T. Henley's 10s shares eased to 18s 6d after the company's decision to keep the dividend at the previous rate of 10½ per cent.

in Electrical Investments

Company or Board	Nom. Value	Middle price 2nd May	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1955 Highest	1955 Lowest
Equipment and Manufacturing—continued.								
Hoover	5/-	46/-		45	70	7 12 2	52/6	40/-
I.C.I.	£1	43/-	−6d	15	10*	4 13 0	45/3	38/3
Intl. Combustion	5/-	27/-		20	25	4 12 6	30/6	23/6
Johnson & Phillips	£1	47/-	−6d	15	15	6 7 9	52/6	45/-
Lancashire Dynamo	£1	61/3		14	15	4 18 0	62/6	55/3
Laurence, Scott	5/-	15/9		20	12½*	4 3 4	16/9	14/6
Lister, R. A.	£1	33/6		12	9·3*	5 11 3	38/3	30/6
London Elec. Wire	£1	53/-	+6d	10	12½	4 14 3	61/-	50/6
Lucas, J.	£1	42/6	−1/3	10·8	7½*	3 10 6	50/6	41/6
Marryat & Scott	2/-	9/6		22½	25	5 5 3	10/4	9/6
Mather & Platt	£1	62/-	−1/-	15	13·4*	4 6 6	63/-	48/-
Metal Industries	£1	33/6	−6d	12	9	5 7 6	38/-	30/-
Midland Elec. Mfg.	£1	46/3		15	10*	4 6 6	46/6	44/-
Morphy-Richards	4/-	27/-		40	35*	5 3 9	31/9	27/-
Murex	£1	54/6	−6d	15	15	5 10 0	57/-	49/3
Newman Ind.	2/-	2/9		10	10	—	3/6	2/4
Oldham & Son	1/-	3/6		17½	17½	5 0 0	3/6	2/10
Parnall (Yate)	5/-	11/-	−3d	8	14	6 7 3	13/2	7/3
Parsons, C. A.	£1	65/-		7½	10	3 1 6	69/6	56/-
Plessey	10/-	63/9	−1/3	30	20*	3 2 9	76/6	57/6
Pye Deferred	5/-	32/6		20	20*	2 19 3	40/6	28/6
Revo	10/-	13/-		27½	9*	6 18 6	15/3	12/6
Reyrolle	£1	92/6		13¾	15	3 4 9	106/3	89/-
Rheostatic	4/-	17/6		20	22½	5 2 9	17/6	14/9
Richardsons Westgarth	5/-	13/9		15	15*	5 9 0	15/-	11/-
Scottish Cables	4/-	20/3		20	27½	5 8 6	22/6	19/6
Smith (England), S.	4/-	16/6		15	17½*	4 4 0	20/-	15/-
Southern Areas	£1	31/3		6	7½	4 16 0	34/9	27/6
Strand Elec.	5/-	9/9		17½	17½	8 19 6	9/9	8/6
Sturtevant	5/-	25/-		18·9	14·4†*	2 17 9†	27/6	21/-
Sun. Elec.	£1	33/9		15	15	8 17 9	34/6	33/9
Switchgear & Cowans	5/-	15/-		10	20	6 13 4	15/6	11/-
Taylor Tunnicliff	5/-	13/3	−6d	12½	15	5 13 3	14/-	11/3
T.C.C.	10/-	47/6		30	25*	5 5 3	48/-	41/-
T.C. & M.	£1	37/6		10	8½*	4 10 9	40/9	35/-
Telephone Mfg.	5/-	9/6		10	10	5 5 3	10/6	9/3
Thorn Elec.	5/-	35/6	+6d	12½	20	2 16 3	37/6	26/3
Thornycroft	£1	40/-		15	15	—	44/-	34/6
Tube Investments	£1	75/-		15	17½	4 13 3	85/9	72/6
Vactric	5/-	13/9	−1/3	Nil	10	—	18/9	12/-
Veritys	5/-	8/-		12½	12½	7 16 3	9/3	7/3
Walsall Conduits	4/-	50/-		70	70	5 12 0	55/-	50/-
Ward & Goldstone	5/-	38/9		45	50	—	43/3	37/6
Watford	2/-	7/3	+3d	22½	25	6 18 0	7/3	6/3
Westinghouse Brake	£1	97/6		16	18	—	101/9	82/-
West, Allen	5/-	14/-		17½	15*	5 7 3	15/6	8/-
Wolf Electric	5/-	18/3		17½	20	5 9 6	19/3	16/1
Trusts, Transport and Communications								
Anglo-Am Tel.:								
A. Ord.	100	77½	+2	6	6	7 14 9	88	75½
Ord.	100	50		3¾	3¾	7 17 6	54½	50
Anglo-Portuguese	£1	24/6		8	8	6 10 9	25/-	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	21/-	−1/-	35	50	—	24/3	19/6
Cable & Wireless:								
Ord.	£1	43/9		9	10	4 11 6	48/9	39/6
4% Loan	100	97½		4	4	4 2 0	100	92
Calcutta Trams	£1	25/-		2½†	6†	4 16 0†	25/-	20/-
Cape Elec. Trams	£1	17/6		5¼	7¼	8 0 0	17/6	16/6
Marconi Marine	£1	37/-	−6d	10	10	5 8 0	37/6	33/-
Oriental Tel. Ord.	£1	98/9		16	16	—	102/6	96/6
Telephone Props.	£1	82/6		—	20	4 17 0	90/6	80/6
Telephone Rentals	5/-	11/6		10	10	4 7 0	77/6	3/3

Cable Results

Johnson & Phillips are paying their regular dividend of 15 per cent for the past year, from net profits which are also around the previous level at £214,000 (after a smaller tax deduction). The preliminary profits statement shows that preference and ordinary dividends together involve the distribution of £168,000 net. The £1 shares were quoted a little lower at 47s after the announcements. Enfield Cables' results are in accordance with the progress report issued in December, when shareholders were advised that, following a substantial loss in the first half of 1954, the various measures initiated by the board and reconstituted management began to show results in the second half. A modest profit is now stated to have been earned in that period, and, with the current outlook reported to be encouraging, the price of the £1 shares remained firm at 20s.

Parnall (Yate)

Results announced by Parnall (Yate) gave further evidence of the busy conditions which prevailed last year in the field of domestic appliances and equipment, or "consumer durables" as the economists like to call them. The company's 5s shares, after being active for some months past in anticipation of good figures for 1954, became a little irregular, around 11s, after the announcement. These show that an increase in the ordinary distribution from 8 to 14 (including bonus of 4) per cent is very comfortably accommodated by the expansion of the net surplus from under £100,000 to £350,000, despite a heavy addition to the tax provision at £311,000 (against £47,000 in the previous year). The yield on the shares now approaches 6½ per cent.

Preference Shares

In sympathy with the gilt-edged market, industrial preference shares have tended to become cheaper. On the popular issues quoted near or under their par values, the yields to a buyer are often in the neighbourhood of a moderate 4¾ per cent (or 10s per cent more than on War Loan) but returns of 5 per cent are available from such higher-priced preference issues as G.E.C. 7½ per cents at 30s, Crompton Parkinson "sixes" at 24s and Ferranti "sevens" at 28s. Yields of around 5½ per cent are shown by, for instance, the 5½ per cent preference stocks of Brush and E.M.I., both offered at a few pence under 20s.

REPORTS and DIVIDENDS

Babcock & Wilcox, Ltd., in a preliminary statement, show group profits of £4,104,153 for 1954, as compared with £4,149,618 for 1953, and after deducting United Kingdom taxation of £2,162,811, the net balance is £1,941,342 (against £1,537,203), of which £1,904,228 is attributable to the parent company. It is proposed to pay a final ordinary dividend of 8 per cent, making 15 per cent for the year on capital of £7,524,398. For 1953 an interim dividend of 7½ per cent was paid before the one-for-two scrip issue, followed by a final dividend of 7 per cent on the present capital, making a total equivalent of 12 per cent on the current equity.

The Brush Group, Ltd.—The report and accounts for 1954 now issued confirm the preliminary figures given in our issue of 1st April.

In his accompanying statement, Sir Ronald W. Matthews (chairman) says that output in 1954 was a record in the case of two of the group factories. In the others the output fell below the level of recent years. The business lies largely in highly competitive overseas markets, and prices in many cases have had to be reduced in spite of rising costs of labour and materials, and the increased profit is a tribute to the efficiency with which the manufacturing resources have been employed. The order book at the end of 1954 stood at a figure closely approximating to twelve months' production and was thus lower than in past years, although the company are now able to quote and to maintain quicker deliveries of many of their products than was formerly possible.

In the present year they were faced with a substantial increase in costs as a result of the rises in prices of raw materials such as steel and copper, and the recent wages award, which is already being reflected in the current quotations from suppliers. Some rise in prices, both in the home and overseas markets, appears inevitable, even in face of unrelenting competition from foreign manufacturers. The losses incurred during 1954 by Associated Tube Wells, Ltd., were well within their estimates and the provisions made for them in previous years proved fully adequate.

After reviewing the progress made by the various companies which form the group, Sir Ronald says that overseas countries continue to expect extended terms of credit, but one of the main problems has been to try to overcome some of the licence and currency difficulties which are at present hampering trade between Britain and other countries, notably in Latin America. Despite these problems, the order intake has been reasonably good. Substantial orders have been received from the Far East, and in the home market a single shipyard ordered forty heavy engines on one contract. Other notable contracts received included one valued at more than £1,300,000 for the electrification of Thailand's rural areas, the scheme involving a total of 239 diesel generating sets with transformers and other equipment to be installed in existing power stations and in several new stations to be built by the Thailand Government.

In the competitive market conditions now facing British manufacturers abroad, first-class service is one of the best ways of ensuring continuity of sales and the benefits derived from their long-standing policy of rendering efficient after-sales service and maintaining supplies of spare parts continue to be substantial.

Johnson & Phillips, Ltd.—The accounts for 1954 show a trading profit of £534,483, as compared with £602,299 for the preceding year, to which is added income from investments, £28,257, transfer fees, £144 and a sum of £50,000 transferred from revenue reserve towards abnormal expenditure on reconstruction of buildings, making a total of £612,885. After meeting all charges, including £175,000 for taxation, there is a net balance of £213,965 (against £214,018). Research and development reserve receives £50,000 and it is proposed to pay a final ordinary dividend of 7½ per cent, making 15 per cent for the year (unchanged). The balance carried forward is £152,136 (against £156,039 brought in).

Parnall (Yate), Ltd.—The group trading profit for 1954 is £780,003, as compared with £200,927 for 1953, and after meeting all charges, including £310,945 for taxation, the net balance is £357,049 (against £91,946). It is proposed to pay a dividend for the year of 10 per cent (against 8 per cent), and in addition to distribute a bonus of 4 per cent. Reserves receive £260,000 and the balance carried forward is £325,487 (against £288,813 brought in).

The Automatic Telephone & Electric Co., Ltd., reports group profits for 1954 of £1,440,400, as compared with £1,441,393 for the preceding year. United Kingdom taxation absorbs £664,514, overseas taxation £39,363, and after crediting £75,000 taxation over-provision, there is a net balance of £811,523 (against £677,430), of which £608,011 is attributable to the holding company. Scientific research reserve receives £324,798 and it is proposed to pay a final dividend of 12 per cent on the ordinary capital, making 15 per cent for the year and a single payment of 15 per cent on the deferred capital (unchanged). Holders of both classes received 10 per cent scrip issues a year ago. The balance carried forward is £760,045 (against £617,018 brought in).

W. T. Henley's Telegraph Works Co., Ltd.—Group profits for 1954 (subject to audit), after meeting all charges, including £432,729 for taxation, are £514,574, as compared with £692,760 a year ago. Reserves receive £100,000 and it is proposed to pay a final ordinary dividend of 8 per cent, maintaining the dividend for the year at 10½ per cent. In addition it is proposed to make a special distribution out of capital profits of 2 per cent, tax free.

Sangamo Weston, Ltd., reports a net profit for 1954 of £118,043, after providing £117,346 for taxation, as compared with a profit for 1953 of £105,806. It is proposed to pay a dividend for the year of 12½ per cent on capital increased by a one-for-two free scrip issue. In 1953 the dividend was 15 per cent on the old capital.

Contactor Switchgear, Ltd.—We regret that in last week's issue the amount of this company's interim ordinary dividend was incorrectly stated. Actually 6 per cent is being paid on the 800,000 5s ordinary shares against 7½ per cent for the previous year on a smaller capital.

Bylock Electric, Ltd.—The annual meeting was held on 22nd April, Mr. C. A. Mathes (chairman) presiding. In his circulated statement, the chairman said that the increase in profit was attributable to the substantial rise in production and to the increased manufacturing facilities which had been available during the year under review. A large proportion of the turnover was in export trade, and they were earning substantial sums in dollars. The position as to forward orders was very healthy and difficulties had been overcome.

T. Clarke & Co., Ltd.—After deducting £29,546 for taxation, the profit for 1954 is £20,492, as compared with £9,111 for 1953. The final dividend on increased capital is 11 per cent (against 9 per cent), making 20 per cent for the year (against 18 per cent).

Veritys, Ltd.—The main figures in the accounts for 1954 were given in our last issue.

In his circulated statement, Mr. H. B. T. Wilde (chairman) says that last year he stated that the company entered 1954 with a satisfactory order book and in spite of the difficulties through shortage of labour, production has been maintained throughout the year. Competition for orders both at home and abroad is still keen and although import restrictions continue in several countries, 25 per cent of production has been exported. The orders on hand will keep the works employed for several months ahead, but the margin of profit will tend to decrease. The increasing difficulty in obtaining export orders in the face of prices quoted by Continental manu-

(*Continued on page* 805)

facturers for marine electrical equipment is a warning that however good the quality of production, the question of price is the deciding factor. In the Fan Department, they are now meeting in the Far East markets extremely low prices quoted by Indian and Japanese manufacturers. Increased and cheaper production is the only answer to this problem.

Enfield Cables, Ltd., reports a group loss for 1954 of £114,875 (against a profit of £296,803 for 1953, before debiting a net loss incurred by Brynmawr Rubber of £238,910). Taxation requires £8,157. After crediting taxation recoverable of £30,000, the group net loss is £93,032 (against a profit of £18,158). After transferring £100,000 from general reserve, the balance carried forward is £85,024 (against £98,681 brought in). No ordinary dividend is to be paid.

The board states that for the first six months of the year a substantial loss was incurred but the second half of the year showed a modest profit. The current trading position and outlook are encouraging.

Powers-Samas Accounting Machines, Ltd.—Vickers, Ltd., propose to make an offer to acquire the whole of the issued shares in Powers-Samas now held by the public. The issued share capital of Powers-Samas is 3,000,000 ordinary shares of 10s each, of which 1,988,397 shares (66·28 per cent) are owned by Vickers. The offer by Vickers, therefore, will be in respect of the remaining 1,011,603 shares and will be made upon the basis of issuing three fully paid ordinary shares of £1 each in Vickers for every two ordinary shares in Powers-Samas and a payment of 3s in cash for each Powers-Samas share.

New Companies

Connectors & Electronics, Ltd.—Registered 6th April. Capital £2,000. Manufacturers of and dealers in electronic equipment and electrical appliances, etc. Directors: A. Drake and Rhoda Drake. Regd. office: 75, Osidge Lane, N.14.

Sandram, Ltd.—Registered 6th April. Capital £2,000. Retailers and manufacturers, importers and exporters of and dealers in radio, television, electrical and electronic goods and accessories, etc. Directors: C. Desmond and E. W. F. Atkins. Regd. office: 7, Elm Parade, Main Road, Sidcup.

Robinson & Lowe, Ltd.—Registered 5th April. Capital £2,000. Electrical engineers and general electrical installation contractors, radio and television engineers, etc. Directors: K. A. Robinson and S. Lowe. Regd. office: 361, Halliwell Road, Bolton.

Waghornes (Electrics), Ltd.—Registered 5th April. Capital £1,000. Manufacturers of and dealers in electrical, gas and oil lamps, fires, stoves, cookers, etc. The first directors are to be appointed by the subscribers. Solicitors: Burton & Ramsden, 81, Piccadilly, W.1.

Croydon Neon Co., Ltd.—Registered 23rd March. Capital £500. Electrical engineering, lighting specialists, etc. Directors: O. J. V. Gatford, Elizabeth S. Gatford and J. Selby. Regd. office: Old Forge, Willett Road, Thornton Heath, Surrey.

J. H. Pickwell, Ltd.—Registered 4th April. Capital £2,000. Electricians, electrical and mechanical engineers and manufacturers, etc. Directors: J. H. Pickwell, J. H. Pickwell, jnr., and Doris I. Pickwell. Regd. office: 108, London Road, East Grinstead, Sussex.

Saco (Electronics), Ltd.—Registered 30th March. Capital £100. Directors: A. H. Saunders and G. Collins. Regd. office: 24, Bryanston Street, Portman Square, W.1.

Levitt Electrical (London), Ltd.—Registered 16th April. Capital £100. Electrical engineers and contractors, etc. Directors: J. Levitt and Mrs. Ray Levitt. Regd. office: 29-31, Euston Road, N.W.1.

P. & R. Electrical (London), Ltd.—Registered 24th March. Capital £1,000. Manufacturers of and dealers in electrical equipment, appliances and fittings of all kinds, etc. Directors: H. B. Feneron and K. C. S. Feneron. Regd. office: 4, Clifford Road, Walthamstow, E.17.

P. J. Walters & Son, Ltd.—Registered 24th March. Capital £2,000. General electrical installation contractors, electric lift engineers, lighting specialists, radio and television engineers, etc. Directors: P. J. Walters, Mrs. Edith W. Walters and A. P. Walters. Regd. office: 3, Cecil Square, Margate, Kent.

Lock Engineering Co., Ltd.—Registered 23rd March. Capital £100. Mechanical and electrical engineers, electrical or general contractors, etc. Directors: Mrs. Marjorie P. Cripps and Mrs. Dorothy R. Locke. Regd. office: 77, Lower Sloane Street, S.W.1.

Warmsley Brothers & Co., Ltd.—Registered 23rd March. Capital £4,000. To acquire the business of electrical engineers and contractors now carried on by Warmsley Bros. & Co. Directors: W. J. A. Warmsley, F. L. Warmsley and J. T. Middlebrook. Regd. office: 216-216a, Southampton Way, S.E.5.

Bletchley Electrical Co., Ltd.—Registered 1st April. Capital £1,000. Directors: E. C. Cook and D. J. Rolls. Regd. office: Draycott, Church Walk, Bletchley, Bucks.

Bromley Electrical Services, Ltd.—Registered 1st April. Capital £1,000. Directors: V. K. English and G. Collins. Regd. office: 109, Burnt Ash Lane, Bromley, Kent.

W. Cummings, Ltd.—Registered 23rd March. Capital £4,500. Dealers in and distributors of electrical, radio and television equipment and component parts thereof, etc. Directors: W. Cummings, P. G. Donald and E. S. Monath. Regd. office: Martins Bank Chambers, 123-125, Clayton Street, Newcastle-on-Tyne.

Lewis Electric Motors (Maidenhead), Ltd.—Registered 1st April. Capital £10,000. To acquire the business of an electrical engineer and electrical equipment manufacturer and distributor carried on by K. A. Vasey at Moor Works, Blackmoor Lane, Maidenhead, etc. Directors: K. A. Vasey and Mrs. Margaret Vasey. Regd. office: Moor Works, Blackmoor Lane, Maidenhead, Berks.

J. L. Griffin, Ltd.—Registered 1st April. Capital £1,000. Manufacturers of and dealers in electrical goods of all kinds, etc. Directors: J. L. A. Griffin and Cecilia L. Griffin. Regd. office: 122, Bristol Street, Birmingham, 5.

Broadway Electrix (Rayleigh), Ltd.—Registered 2nd April. Capital £1,000. Electricians, etc. Directors: W. H. C. Broadway, Mrs. Rose E. Broadway and J. M. Smith. Regd. office: 107, London Road, Rayleigh, Essex.

C. Gilbert, Ltd.—Registered 13th April. Capital £5,000. To acquire the business of an electrical engineer and contractor, radio and television dealer carried on by C. Gilbert at Long Eaton, Derbys. Directors: C. Gilbert and Mrs. Mary Gilbert. Regd. office: 69, High Street, Long Eaton.

Increase of Capital

Belco (London), Ltd.—Increased by £25,000, in £1 ordinary shares, beyond the registered capital of £25,000.

Liquidation

Dalmere Electronics, Ltd.—Winding up voluntarily. Liquidator, Mr. S. P. Heath, 78, King Street, Manchester, appointed 13th April.

Bankruptcies

J. W. Luker and **H. A. R. Phillips,** lately carrying on business in partnership at East Street, Lewes, and at 206, High Street, Lewes, under the style of Gordon & Luker, electrical contractors (separate estate of J. W. Luker).—Order of discharge made 16th March subject to debtor's consenting to judgment being entered against him by the Official Receiver for £300 to be paid as to £150 by 30th June, and £150 by 31st December next.

P. A. Cockcroft, formerly carrying on business as a radio and electrical engineer at Brook House, Penrhyn Avenue, Rhos on Sea, Denbigh.—Last day for receiving proofs for dividend 11th May. Trustee, Mr. E. C. Stimpson, 27, Regent Street, Park Row, Nottingham, Official Receiver.

A. C. Payne, formerly carrying on business at 40, Springfield Road, Wickersley, Rotherham, as electrical contractor.—First and final dividend of 3s 2d in the £, payable at the Official Receiver's office, 55, Queen Street, Sheffield.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 8th June from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1949

14951. National Research Development Corporation.—Electronic digital computing devices. 5th June, 1950. (731341.)

1950

21013. Sylvania Electric Products, Inc.—Electroluminescent lamps and methods. 24th August, 1950. (731345.)

24498. Sangamo Weston, Ltd.—Variable electrical resistances. 5th July, 1951. (731523.)

1951

77. Postmaster General.—Circuits for producing frequency or phase modulation. 18th November, 1952. (731592.)

1095. General Electric Co., Ltd., and Wright, D. A.—Thermionic cathodes. 2nd January, 1952. (731421.)

1096. M-O Valve Co., Ltd., and Wright, D. A.—Thermionic valves. 2nd January, 1952. (731422.)

10587. Licentia Patent-Verwaltungs Ges.—Short-time electric switch. 4th May, 1951. (731593.)

28350. Taylor, A. M.—Electric protective apparatus. 26th February, 1953. (731350.)

28682. Vainicher, B. E.—High voltage insulator. 7th December, 1951. (731599.)

1952

7105. British Thomson-Houston Co., Ltd.—Water heating and room cooling systems. 19th March, 1952. (731261.)

9586. Purdue Research Foundation.—Electrical impulse generators. 16th April, 1952. (731265.)

11294. Igranic Electric Co., Ltd., and Taylor, J. R.—Electric motor controllers. 5th May, 1953. (731360.)

11341. Standard Oil Development Co.—Electrical process for breaking emulsions and apparatus therefor. 5th May, 1952. (731606.)

13815. Standard Telephones & Cables, Ltd.—Waveguide apparatus for varying the polarization of electromagnetic waves. 30th May, 1952. (731362.)

14173. Electric & Musical Industries, Ltd.—Electron discharge devices employing hollow resonators. 5th June, 1953. (731436.)

14498. Sylvania Electric Products, Inc.—Electroluminescent materials. 9th June, 1952. (731364.) 14499/14500/1. Electroluminescent lamps. 9th June, 1952. (731365/6/7.)

17541. Plessey Co., Ltd.—Ceramic materials applicable in low voltage ignition systems or resistor elements. 10th July, 1953. (731372.)

18274. M-O Valve Co., Ltd., and Aldous, W. H.—Thermionic valves. 9th October, 1953. (731613.)

18275. General Electric Co., Ltd., and Aldous, W. H.—Thermionic cathodes. 9th October, 1953. (731614.)

18372. British Thomson-Houston Co., Ltd.—Power actuated air or oil circuit breakers. 10th July, 1953. (731280.)

20586. General Electric Co., Ltd., and Riches, E. E.—Piezo-electric accelerometers and a method of manufacturing same. 4th August, 1953. (731378.)

21346. Metro-Cutanit, Ltd.—Manufacture of electric resistance heating elements. 25th August, 1952. (731616.)

22380. English Electric Co., Ltd.—Electric transformers. 4th September, 1953. (731617.)

22991. Marconi's Wireless Telegraph Co., Ltd.—Radio direction finders. 13th August, 1953. (731619.)

24635. General Electric Co., Ltd., and Williams, C. E.—Circuit arrangements for operating electric lamps. 23rd September, 1953. (731384.)

26589. Covill, D. H.—Arrangements for use with cathode-ray tubes. 13th October, 1953. (731451.)

26929. General Electric Co.—Hydraulic servo mechanisms for adjustable ratio dual fuel systems. 27th October, 1952. (731622.)

26973. Metropolitan-Vickers Electrical Co., Ltd.—Mounting of electric busbars and the like. 27th October, 1953. (731623.)

27081. Metropolitan-Vickers Electrical Co., Ltd.—Electron emissive devices. 7th October, 1953. (731454.)

29983. British Telecommunications Research, Ltd.—Electrical impedance matching. 3rd November, 1953. (731624.)

30261. Marconi's Wireless Telegraph Co., Ltd.—Electric switch control mechanisms. 16th June, 1953. (731625.)

30557. Metropolitan-Vickers Electrical Co., Ltd.—Dynamo-electric machines. 8th September, 1953. (731299.)

30749. Telefunken Ges. für Drahtlose Telegraphie.—Thermionic valve amplifying and frequency changing circuit arrangements. 4th December, 1952. (731551.)

1953

760. Metropolitan-Vickers Electrical Co., Ltd.—Shaving gears and gear shaving machines. 8th January, 1954. (731306.)

1194. Allday & Son (1922), Ltd., H.—Wall boxes for electric switches. 6th January, 1954. (731465.)

2113. Plessey Co., Ltd.—Wire wound resistors. 15th January, 1954. (731392.)

2225. British Insulated Callender's Cables, Ltd.—Joint for an electric cable. 25th January, 1954. (731308.)

3423. General Electric Co., Ltd., and Bryer, R. F.—Automatic control systems. 5th February, 1954. (731472.)

3879. Telefunken Ges. für Drahtlose Telegraphie Ges.—Amplifiers employing transistors. 11th February, 1953. (731393.)

4097. Western Electric Co., Inc.—Electromagnetic wave guiding members and apparatus. 13th February, 1953. (731473.)

4322. International Combustion (Holdings), Ltd. (Combustion Engineering Superheater, Inc.).—Steam generators. 16th February, 1953. (731311.)

6826. British Thomson-Houston Co., Ltd.—Ozonizing apparatus. 12th March, 1953. (731317.)

7465. Saint-Vaulry, P. D. de.—Anodes for electric cells. 18th March, 1953. (731399.)

10438. General Electric Co., Ltd.—Containers for electric lamps. 14th April, 1954. (731479.)

10479. British Insulated Callender's Cables, Ltd.—Means for securing electric cables to a support. 15th April, 1954. (731481.)

11716. General Electric Co.—Control of electric motors. 28th April, 1953. (731570.)

13659. Western Electric Co., Inc.—Multi-contact electromagnetic relays. 15th May, 1953. (731486.)

14602. Zeiss-Stiftung, C. (trading as Jenaer Glaswerk Schott & Gen.).—Method for the electric melting of glass. 26th May, 1953. (731405.)

16015. Landis & Gyr Akt.-Ges.—Multiple tariff counting mechanism for electricity meters. 10th June, 1953. (731491.)

17249. Calor- Emag Elektrizitäts Akt.-Ges.—Electric cables, more especially rubber sheathed cables for use in mines, in combination with protective arrangements. 22nd June, 1953. (731492.)

17954. General Electric Co.—Buckets of axial-flow machines of the turbine and compressor kind. 29th June, 1953. (731329.)

20396. Standard Telephones & Cables, Ltd. (Lorenz Akt.-Ges., C.).—Band pass filter for decimetric and centimetric wave. 22nd July, 1953. (731498.)

20777. British Thomson-Houston Co., Ltd.—Magnetic cores. 27th July, 1953. (731500.)

21858. General Motors Corporation.—Electrical switch mechanism. 7th August, 1953. (731502.)

23125. General Electric Co.—Heater supply arrangements for electronic devices. 21st August, 1953. (731333.)

24411. British Thomson-Houston Co., Ltd.—Dynamo-electric machines. 31st August, 1954. (731581.)

26702. Erie Resistor Corporation.—Printed electric circuits. 29th September, 1953. (731509.)

26994. Telefonaktiebolaget L. M. Ericsson.—Ringing devices for telephone systems. 1st October, 1953. (731582.)

27007. Electric & Musical Industries, Ltd.—Apparatus for converting digital code signals to analogue signals. 19th January, 1951. (731650.)

27888. Albiswerk Zurich Akt.-Ges.—Circuit arrangements for stopping a motor selector in telecommunication installations, more especially telephone installations. 9th October, 1953. (731651.)

31995. Barnes Drill Co.—Magnetic separators. 18th November, 1953. (731655.)

32590. General Electric Co.—Direct current restoration circuits. 24th November, 1953. (731656.)

33040. British Thomson-Houston Co., Ltd.—Method of and apparatus for forming and mounting an electrode structure in electric lamps and similar devices. 27th November, 1953. (731587.)

33486. Philips Electrical Industries, Ltd.—Electric discharge tubes having gilded contact members. 2nd December, 1953. (731588.)

34508. General Motors Corporation.—Dynamic brake system for electric locomotives. 11th December, 1953. (731519.)

34570. Philips Electrical Industries, Ltd.—Electric incandescent lamps. 11th December, 1953. (731414.)

36032. Forges et Ateliers de Constructions Electriques de Jeumont.—Armoured sheath electric cables and their manufacture. 29th December, 1953. (731589.)

1954

36797. General Electric Co.—Reversible split-phase motors. 28th April, 1953. (731590.)

Engineering Work for Ulster

A deputation of twelve senior representatives of Northern Ireland firms which are members of the Engineering and Allied Employers' Association recently visited the Ministry of Supply in London for exploratory talks with a view to obtaining more general engineering work for Northern Ireland. The purpose of the delegation was to lay before the Ministry a full statement on the engineering capacity available in Northern Ireland and to know the kind of work needed by the Ministry and the way in which it allocated contracts.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Armagh.—13th June. County Education Committee. Electrical installation in proposed county intermediate school at Cloundagh, Portadown. J. R. W. Murland, consulting engineer, 13, Wellington Place, Belfast.

Belfast.—13th May. Northern Ireland Housing Trust. Electrical installation in 4 shops, 8 flats, and 14 maisonnettes at Andersonstown No. 3 site. Offices of the Trust, 12, Hope Street.

Belgium.—16th May. Ministère de la Défense Nationale de Belgiques. Cables and alterations to electrical installations (£4,300). (E.S.B. 1071/55. Ten/13589.)* Two high voltage cabins, cable and modifications to electrical installations (£12,000). (E.S.B. 1071/55. Ten/13590.)*

Bentley-with-Arksey.—16th May. U.D.C. Electrical installations in 19 bungalows. Surveyor, Council Offices, Cooke Street.

Birmingham.—25th May. City Public Works Committee. Street lighting equipment. (See this issue.)

Cumberland.—18th May. County Council. Electrical wiring and fixing of fittings at Wilson Secondary School, Workington. County architect, 15, Portland Square, Carlisle.

Durham.—County Council. Electrical installations in Billingham North Modern School, Bowburn Modern School and Durham School Clinic. (See this issue.)

Ecuador.—15th May. State Railways. Air compressor and two turbo-generators. (E.S.B. 9248/55. Ten/13612.)*

Egypt.—12th July. Director-General, Mechanical and Electrical Department, Ministry of Public Works, Cairo. 15,000 kW turbo-generator, steam boilers, transformers, etc., for ATF power station, Mahmoudia. (E.S.B. 9071/55. Ten/13606.)*

India.—19th May. Director General of Supplies and Disposals, New Delhi. V.i.r. cables. (E.S.B. 8765/55. Ten/13550.)* 26th May. Eleven 50-300 kW generating sets, five 50-100 kW alternators and diesel engines for Rajasthan. (E.S.B. 8657/55. Ten/13547.)*

Iraq.—31st August. Ministry of Development. Construction of dam for the Derbend-i-Khan project, including electrical plant and equipment. (E.S.B. 8763/55. Ten/13581.)*

Larne.—11th May. Board of Governors of Larne Grammar School. Electrical installation in the new detached science block. A. G. Crawford, quantity surveyor, 1, Lombard Street, Belfast.

Romford.—16th May. Borough Council. Two electric street orderly trucks. Borough surveyor, Town Hall.

Sligo.—13th May. Electrical services in Cregg House, Co. Sligo, for the Mother Superior. B. F. Rhatigan, architect, 1, Teeling Street.

South Africa.—25th May. Stores Department, South African Railways. Private automatic exchange. (E.S.B. 8825/55. Ten/13514.)* 660 and 250 V cable. (E.S.B. 8804-5/55. Ten/13553 and 6.)* 26th May. 11 kV switchboard and two 100 kVA, 400-230 V transformers. (E.S.B. 8891/55. Ten/13562.)* Underground cable. (E.S.B. 8802/55. Ten/13552.)* 2nd June. One electric goods lift. (E.S.B. 8809/55. Ten/13523.)*

26th May. City of Cape Town Electricity Department. Two 30,000 kVA transformers. (E.S.B. 8755/55. Ten/13558.)*

3rd June. Corporation of City of Durban. Flameproof telephone wire. (E.S.B. 8875/55. Ten/13582.)*

Pretoria. A list of approved tenderers for the supply to the Department of Posts and Telegraphs of switchboard lamps is being prepared. Firms desirous of being included in the list should apply as soon as possible to the Controller of Post Office Stores, P.O. Box 447, Pretoria. (E.S.B. 9782/54. Gen/1976.)*

Syria.—6th June. Direction-General du Service d'Installation des Telephones, Damascus. Armoured lead cables. (E.S.B. 9226/55. Ten/13620.)*

United States.—19th May. Bureau of Reclamation. Interrupter and air switches for Gila substation. (E.S.B. 9013/55. Ten/13571.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aldridge.—Public hall (£75,000); C. Andreason, U.D.C. surveyor, Daw End, Rushall, near Walsall.

Ashton-under-Lyne. — Dwellings (148), Neal Avenue and Charlestown Road; borough surveyor.

Barnes.—Assembly hall proposed on site fronting municipal offices (£66,000); W. R. Shepherd, borough surveyor, Municipal Offices, Sheen Lane, East Sheen, London, S.W.14.

Basildon.—Dwellings (727), Fryerns area, for Development Corporation; W. & C. French, Ltd., builders, Buckhurst Hill.

Bebington.—Stage 1 of new town hall; Willink & Dod, architects, Cunard Buildings, Liverpool, 3.

Birkenhead.—Workshops, offices and stores, Hilbre Street; C. & H. Crichton, Ltd., Townsend Street, Liverpool.

Birmingham.—Ward block at the Woodlands Orthopædic Hospital, Northfield (£92,383) and detached block for mental patients at Highcroft Hall Hospital (£62,000); Regional Hospital Board Offices, 10, Augustus Road, Edgbaston, 15.

Aged persons' home, Lyndhurst estate; city architect.

Works and offices, Curzon Street and Penn Street; Wm. Hopkins & Sons, Ltd., Albert Street.

Bradford.—Metalwork centre at Drummond Secondary School, and two primary schools at Halifax Road; W. H. Leathem, town clerk.

Bristol.—Four-storey block of staff offices on site fronting Castle Street; city architect, Eagle House, Colston Avenue, 1.

Works and offices for Arthur Scull & Sons, Ltd.; Alec F. French, architect, Halifax House, St. Augustine's Parade.

Carlisle.—Cinema at Harraby Neighbourhood Unit for Rural Cinemas & Entertainment, Ltd.; Graham & Roy, architects, Paternoster Row.

Chichester.—Showrooms, offices and warehouse, Market Road; G. Pine, Ltd., Eastgate Square.

Coventry.—Showrooms and offices, Union Street; Sam Robbins, Ltd., 25, Albert Street.

Baths, Primrose Hill; city architect.

Darlington.—Bus station at Feethams; United Automobile Co., Ltd.

Churches in North Road and Yarm Road for the Durham Diocesan Committee, Durham City.

Derbyshire.—Breaston Secondary Modern School; S. Morrison & Partners, architects, 39, Full Street, Derby.

Doncaster.—North Bridge bus station; borough architect.

Durham.—Brickworks; Crossley Building Products, Ltd., Middlesbrough.

Additions to physics department and erection of workshops at the science laboratories for the Council of Durham Colleges; C. Elgey, architect, 7a, North Bailey.

Ealing.—Additions and extensions to works; Glaxo Laboratories, Greenford Road, Greenford.

Enfield.—Houses (104), Holtwhites Hill; borough surveyor.

Factory; Scroll Pens, Ltd., Lockfield Avenue, Brimsdown.

Factory in Wharf Road; London Plywood & Timber Co., Ltd., 384, Old Street, London, E.C.1.

Golborne.—Clinic for C.C. (£7,639); Kearsley & Gee, Ltd., Ashton-in-Makerfield.

Goring-on-Sea.—R.C. secondary school; Walters & Kerr-Bate, architects, 14, Gray's Inn Square, London, W.C.1.

Great Yarmouth.—Three-storey building for 510 pupils, Girls' High School, Gorleston; F. Jackson, schools architect, 22, Euston Road.

Harlow.—Houses (255) at Hare Street, Little Parndon, for Development Corporation; W. E. Adams, general manager, Terlings, Cilston, Harlow.

Hereford.—Crematorium in Westfaling Street; F. Margerison, city surveyor, Town Hall.

Jarrow (Co. Durham).—Baptist church and hall at Perth Avenue; G. C. Young, architect, 12, Grange Road West.

Kingston-on-Thames.—Out-patients' block, clinics, etc., for Kingston Hospital; Gordon Jeeves & Partners, architects, 61, Catherine Place, London, S.W.1.

Leyton.—Extensions; Arcola Shoe Works, Ltd., High Road.

Liverpool.—Rebuilding works in Mill Lane for Hugh Lewis & Son, Ltd., rope manufacturers; E. G. Hearnden, architect, 62, Dale Street, Liverpool, 2.

Llanelly.—Works extensions; Waddle Patent Fan & Engineering Co., Ltd., Llanmor Works.

London.—Office block, Cheapside; Sun Life Assurance Society, 1, Threadneedle Street, E.C.2.

Flats (100) and eight shops, Homerton High Street, Hackney; borough engineer.

Margate. — Westgate branch library (£15,000); borough engineer.

Monmouthshire.—County secondary school at Croesyceiliog, and Oakfield Mixed County School at Cwmbran; county architect, Queen's Hill, Newport.

Newcastle-on-Tyne. — Medical centre, offices, etc., at Quayside; Chas. S. Errington, architect, 46, Grainger Street.

Additions to Cross House Buildings, Westgate Road (£50,000); Cackett, Burns Dick and Mackellar, architects, 21, Ellison Place.

Proposed new town hall for the City Council; R. G. Gregory and Partners, electrical consultants, Pilgrim House.

Newcastle-under-Lyme. — Works extensions, Brampton Hill, for G. H. Downing & Co., Ltd.; T. J. Madew, architect, Marsh Parade.

Pembrokeshire.—Police headquarters at Pembroke Dock, and police stations and houses at Fishguard and Tenby, for Standing Joint Committee; county architect, County Offices, Haverfordwest.

Rainham (Essex).—Foundry on site in New Road; Ford Motor Co., Ltd., Dagenham.

Redruth.—Extensions to factory; Graham Brabyn, Ltd., knitwear manufacturers, Foundry Road.

Romford.—Factory; Thomas Bates & Sons, Ltd., Church Road, Harold Wood.

Rotherham.—Works, Brinsworth Street; Montgomery, Skinner & Co., Ltd., Pagoda Street, Sheffield.

Sheffield.—Health centre and hostel for aged persons, Greenhill-Bradway estate; city architect.

Factory, Fitzwilliam Road; Wm. Cooke & Co., Ltd., Tinsley Works.

Solihull.—Library at Hobs Moat, Sheldon (£21,593); C. R. Hutchinson, borough surveyor, 90, Station Road.

Sunderland.—Civic theatre (£400,000), public baths (£250,000), and extensions to Central Library; borough architect.

Torquay.—Factory proposed in Newton Road; Gravely Overseas, Ltd., Dart Mills, Buckfastleigh.

Walsall.—County primary school in Hatherton Lane, Leamore (£103,000); M. E. Habershon, borough surveyor, Council House.

Wednesfield.—Welfare centre and houses (6), Neachells Lane, for Old People's Welfare Committee and U.D.C.; T. A. Peacock, surveyor, 29, Bolton Road.

Wolverhampton.—Two-storey shops (24) in town centre (£250,000), for Horton's Estate, Ltd., 31a, Colmore Row, Birmingham, 3; Nicol, Nicol & Thomas, architects, 111, New Street, Birmingham, 2.

Worcester.—Houses (50), Warndon site; city engineer, 22, Bridge Street.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 20th May:—

VENTEX. No. 730,586, Class 7. Air filtering apparatus and air cleaning apparatus, all being parts of engines, of motors and of machines. VENTEX. No. 730,588, Class 9. Air filtering and air purifying apparatus for scientific purposes. VENTEX. No. 730,587, Class 11. Air filtering and air purifying installations (none being for scientific purposes or parts of engines, of motors or of machines). —Ozonair Engineering Co., Ltd., Ozonair Works, The Esplanade, Rochester, Kent.

NOVUM. No. 735,630, Class 7. Electric washing machines and electric drying machines, all for domestic purposes.—Novum, Ltd., 12A, Lower Abbey Street, Dublin, Irish Republic. Address for service, c/o H. D. Fitzpatrick & Co., 3, Gray's Inn Square, London, W.C.1.

REXAIR. No. 734,776, Class 9. Electric vacuum cleaners and parts and fittings.—Martin-Parry Corporation, Toledo, Ohio, U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, London, W.C.2.

RHODOTEX. No. 735,756, Class 9. Electrical apparatus and instruments; scientific, optical, cinematographic and sound reproducing instruments and apparatus, etc.—Société des Usines Chimiques, Rhone-Poulenc, Paris, France. Address for service, c/o W. Symmons & Co., Bank Chambers, 329, High Holborn, London, W.C.1.

VISCOSON. No. 739,028, Class 9. Electrical apparatus and instruments and scientific apparatus, all for use in determining the properties of fluids.—Bendix Aviation Corporation, New York, U.S.A. Address for service, c/o F. J. Cleveland & Co., 29, Southampton Buildings, Chancery Lane, London, W.C.2.

CONYSOL. No. 739,136, Class 9. Electric cables and insulated electric wires.—Connollys (Blackley), Ltd., Blackley Vale Mills, Blackley, Manchester.

NICROSIL. No. 739,043, Class 10. Heating elements being parts of electro-medical heat radiation appliances.—Hanovia, Ltd., Bath Road, Cippenham, Slough, Bucks.

NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 9th May

CARDIFF.—At the South Wales Institute of Engineers, Park Place, 6 p.m. Institution of Civil Engineers, S. Wales & Mon. Association. Annual general meeting, followed by engineering films.

LONDON.—St. Ermins Hotel, Caxton Street, 7 p.m. A.S.E.E. Central London Branch. "Electrical Instruments," by G. E. Edwards.

STAFFORD.—At the English Electric Co.'s Lecture Room, Salt Avenue/Sabine Street, 7.15 p.m. I.E.E. North Staffs. Sub-Centre Students' Section. Annual general meeting and film evening.

Tuesday, 10th May

BELFAST.—Queen's University, 6.30 p.m. I.E.E. Northern Ireland Centre. Annual general meeting, followed by "The Post," by J. Johnstone.

LONDON.—Savoy Hotel, 12.30 for 1 p.m. British Electrical Development Association. Annual luncheon.

At the Royal Society of Arts, John Adam Street, 6 p.m. Illuminating Engineering Society. Annual general meeting. Lecture on "The Illuminated Chateaux of France," by J. J. Chappat.

MANCHESTER. — Engineers' Club, Albert Square, 7.15 p.m. Incorporated Plant Engineers, Manchester Branch. "Notes on the Statutory Requirements of Steam and Pressure Vessels and Machinery," by W. H. Mills.

NEWPORT.—Flying Services Club, 28, High Street. Newport & District Electric Club. Annual general meeting.

Wednesday, 11th May

ABERDEEN.—Caledonian Hotel, 7.30 p.m. I.E.E. North Scotland Sub-Centre. Annual general meeting, followed by films.

BIRMINGHAM.—James Watt Institute, 6.45 p.m. I.E.E. South Midland Centre Students' Section. Annual general meeting and films evening.

Chamber of Commerce, New Street, 7.15 p.m. A.S.E.E. Birmingham Branch. Film show.

GLASGOW. — 425/427, Sauchiehall Street, 7 p.m. Incorporated Plant Engineers, Glasgow Branch. "The Human Factor and Productivity," by Mrs. T. M. Ritchie.

HALIFAX. — A.S.E.E. Bradford Branch. "Aims and Objects of the A.S.E.E.," by L. L. Emmett.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Radio Section. Group of papers on "Transistors and other Semi-Conductor Devices," including "Junction Transistor Noise in the Frequency Range 7-50 Kc/s," by W. L. Stephenson; and "Noise in Silicon Microwave Diodes," by G. R. Nicoll.

I.E.E. London Students' Section. Visit to L.T.E. Repair Works, Acton, at 2 p.m.

LONDON.—St. Stephen's Club, 1, Bridge Street, S.W.1, 6 for 6.30 p.m. Engineering-Legal Society. "The Responsibilities of a Consulting Engineer," by K. H. Tuson.

NORTHAMPTON. — College of Technology, 7.15 p.m. Northampton & District Electrical Association. Annual general meeting.

NOTTINGHAM. — County Hotel, 7 p.m. Incorporated Plant Engineers, East Midlands Branch. Ladies' film evening.

Thursday, 12th May

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. Extra meeting. Discussion on "Image Intensification in Radiology," opened by Dr. W. J. Oosterkamp and Dr. G. M. Ardran.

NEWCASTLE-UPON-TYNE.—Roadway House, Oxford Street, 7 p.m. Incorporated Plant Engineers, North-East Branch. Film.

CATALOGUES AND LISTS

ACCESSORIES.—Price list of the company's range of electrical accessories.—**Ashley Accessories, Ltd.,** Ulverston, Lancashire.

CIRCUIT-BREAKERS.—Booklet (S.G. 230) dealing with the company's "Natural Flow" arc control device for oil circuit-breakers.—**English Electric Co., Ltd.,** Switchgear Sales Department, Stafford.

CONTROL GEAR.—Illustrated brochure describing control gear for water pumping plant and associated services, with a list of typical installations in pumping stations, sewage works and dry docks.—**Allen West Co., Ltd.,** Brighton, 7.

ELECTRIC COOKER.—Leaflet illustrating and describing the Model 550 "Coronet" cooker.—**Tricity Cookers, Ltd.,** 109, Kingsway, London, W.C.2.

INFRA-RED LAMP.—Descriptive booklet dealing with the "Elstein" infra-red radiator for local heat therapy.—**P. & R. Electrical Co.,** London, W.3.

INSULATING MATERIALS.—16-page illustrated booklet (C.14) giving details of a range of silicone electrical insulating materials and components.—**Midland Silicones, Ltd.,** 19, Upper Brook Street, London, W.1.

Illustrated 38-page publication dealing with electrical insulating varnishes, enamels and compounds.—**Pinchin, Johnson & Co.,** 4, Carlton Gardens, London, S.W.1.

LIGHTING FITTINGS.—46-page illustrated, descriptive catalogue covering the complete range of the company's fittings for outdoor lighting.—**The Benjamin Electric, Ltd.,** Tottenham, London, N.17.

Leaflet (P.D.U.1) dealing with the company's new "Princess" and "Empress" decorative and diffused lighting units.—**Morley's Electrical Services (Holloway), Ltd.,** 117, Hornsey Road, London, N.7.

84-page illustrated and priced catalogue (L.967/m) covering Mazda lighting fittings and auxiliaries.—**British Thomson-Houston Co., Ltd.,** Crown House, Aldwych, London, W.C.2.

Leaflet (SL.2.55) describing the "Side-of-House" lantern designed primarily for Group B street lighting.—**Holophane, Ltd.,** Elverton Street, London, S.W.1.

Leaflet illustrating the Ekco 5ft slim batten fluorescent fitting.—**Ekco-Ensign Electric, Ltd.,** 45, Essex Street, Strand, London, W.C.2.

LAWN MOWERS.—Leaflet dealing with 12in and 14in self-propelled electric lawn mowers.—**H. C. Webb & Co., Ltd.,** Tame Road, Witton, Birmingham, 6.

METALS.—Leaflet describing "Elmet" contact metals for electrical switchgear, etc.—**Metro-Cutanit, Ltd.,** Grappenhall, Warrington, Lancs.

MOTORS.—Illustrated descriptive booklet (P.S.120) dealing with motors for power station auxiliaries.—**English Electric Co., Ltd.,** Plant Sales Department, Stafford.

12-page price list dealing with a range of squirrel cage motors from 1 h.p. to 250 h.p. Also lists (J.2) covering fractional h.p. motors and (B.15) giving information regarding the company's new range of interchangeable protected and totally enclosed fan-cooled types which are interchangeable with the American N.E.M.A. and Canadian C.E.M.A. 60 c/s motors.—**Lancashire Dynamo & Crypto, Ltd.,** Trafford Park, Manchester, 17.

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